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MINERAL CONTENT OF PASTURES.

LIME-DEFICIENT AREAS AND A HITHERTO UNSUSPECTED MALNUTRITION DISEASE IN SHEEP.

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A TYPE of air-borne volcanic soil differing greatly in response to fertilizers and in agricultural value from the coarser pumiceous sandy and sandy-silt soils of the central district of the North Island is the volcanic loam of what is known as the King-country. This loam has been derived by weathering from showers of fine volcanic dust or mud, and is described by Henderson and Ongley (Bull. Geological Survey No. 24, p. 56). The analytical examination of this type of soil and of the pasture growing upon it has been the subject of recent investigation. In August, 1926, the writer was first consulted regarding a loam soil which, with its subsoil, showed a very characteristic section in the road-cuttings — a brown loamy face which cracks up in summer, then appearing as a much-fissured surface exactly similar to that described by Henderson and Ongley.

This type is abundantly distributed in the Mairoa Riding of Waitomo County, about fifteen miles west of Te Kuiti, at an elevation of about 1,000 ft. above sea-level. The local rainfall is a heavy and well-distributed one; the surface features show what the farmer would call "easy country," and the native vegetation originally consisted of forest and shrubs of a type that might be called mixed rimu-tawa forest, which indicates good soil rather than bad. On many farms the forest had been burnt off over twenty years previously, and, generally speaking, the whole area consisted of surface-sown pasture, a great deal of which had reverted to fern and second growth. Where the pasture was still maintained it had reverted from the ordinary grasses sown on the burn, including rye-grass, cocksfoot, and clovers, to danthonia, Yorkshire fog, and brown-top. The complaint one had to investigate was not so much the fact of decreased carrying-capacity of pastures which had for their first seven or eight years after the burn carried one and a half ewes to the acre, and now only carried less than one dry sheep, but that even with that diminished stocking the animals did not thrive, and the number of culls in the flock greatly diminished or altogether extinguished the profit. There was very little cultivation

practised, and club-root (finger-and-toe) disease in cruciferous crops grown in field or garden was alleged to be an invariable occurrence.

Nine soils and subsoils (W 506–514) from Mairoa were examined in September, 1926, and showed that the "lime-requirement" by Hutchinson and McLellan's method ranged from 0·8 to 1·22 per cent. calcium carbonate, which means that to fully satisfy this requirement would take about 10 tons of crushed limestone per acre. There was one exception. This country, it should be mentioned, is characterized by the outcropping on the hills and many of the gullies of a pure, hard, white limestone, often standing out in picturesque pillar-like masses. If a sample of soil or pasture was taken near the influence of these limestone outcrops, in the one case the lime-requirement was lowered to a figure something like that of the average acid soils of the North Island, and in the other case (the pasture) the calcium content was found to be from two to three times as great as a sample gathered from soil away from the limestone influence. These lime-requirement tests were done on both soil which had had no top-dressing and on soil which had been heavily top-dressed with superphosphate and potash, and it was evident that the top-dressing had not appreciably altered the "lime-requirement" figure. Moreover, the soil taken near the limestone contained from two to three times the quantity of calcium extracted by hydrochloric and citric acid as that sample taken away from the influence of limestone, and the soil acidity was found to be much higher in the latter than in the former case.

The worst soils for "dopiness," as the local farmers call the deficiency disease, are those of settlers who will be termed here "Farmer O'M.," "Farmer MacC.," and "Farmer N.," while "Farmer T.'s" land is generally recognized as superior. The samples of soil drawn near the limestone outcrops (separated by lines from the others in the following table) are outstanding in their composition compared with the soil away from the influence of limestone.

Table 1.—Correlation of Sourness with Lime Content and Requirement in Mairoa Soils.

Location of Soil.	Calcium Oxide (Lime) extracted by		Lime-requirement Figure.	pH Figure.*
	Citric Acid.	Hydrochloric Acid.		
Farmer O'M.:				
No. 1 pasture	0·15	0·59	1·20	5·2
Virgin forest	0·23	0·74	0·89	5·8
Northern paddock	0·15	0·57	0·99	5·3
No. 2 paddock	0·13	0·65	1·01	5·3
Near limestone	0·57	1·63	0·38	6·3
Farmer McC.	0·12	0·53	0·67	5·0
Farmer N.	0·19	0·84	0·75	5·4
Farmer N. (Ngapenga No. 2) ..	0·20	0·81	0·95	5·4
Farmer T. (good soil)	0·39	1·00	0·56	6·1

* The values given under "pH Figure" indicate the relative degree of soil acidity. pH 7·0 = neutrality; higher figures indicate increasing alkalinity, and lower figures increasing acidity as the figures diminish.

It is satisfactory to obtain confirmation of one's analytical results by means of figures derived from another analyst's work done in another laboratory. A well-known agricultural chemist has examined a similar but better soil at Aria (a neighbouring locality), and finds " a very high lime-requirement " of land grassed twenty years, and recommends " 2 tons of ground limestone per acre," and to experiment with mineral supplement feeding for stock. Another agricultural chemist, working in a third laboratory, also obtained a lime-requirement figure for a Mairoa soil similar to that found in the Agriculture Department's laboratory.

The next step was to analyse the soils fully, both for chemical and mechanical analysis. The mechanical analysis of a composite sample of Mairoa soil (W 609) showed that it was a loam soil containing in percentages on the air-dried soil of the fine earth passing a 2 millimetre sieve : 0·5 fine gravel, 9·4 coarse sand, 15·0 fine sand, 14·1 silt, 12·3 fine silt, 15·1 clay, 8·3 moisture, and 27·6 loss on ignition.

The same composite sample (W 609), containing samples mostly from top-dressed land, showed on chemical analysis (Table 2) high amounts of mineral plant-foods, both available and total, usually supplied in artificial fertilizers. The loss on ignition was high, and the total nitrogen was very high. The analysis, therefore, showed that the soil was not deficient in the usual plant-foods it is necessary to supply in fertilizers—nitrogen, potash, and phosphates—to such an extent that the health of the stock could be affected.

Other soils were analysed from lands which had not been top-dressed, and, although the available phosphate was, as might be expected, lower, it was still present in amounts relatively high for a hill soil. The outstanding feature in the analyses was the high lime-requirement in every case, except those samples taken from near limestone outcrops and from farms known to be of better quality as regards feeding-capacity and health of stock. Therefore, it did not appear that there was any deficiency, whether of phosphates or potash, which could account for the failure of the stock to develop in a normal manner. The writer visited the district in November, 1926, and could find no dearth of feed such as would account for the ill-nourished condition of the sheep. The most extraordinary statement received was that although a top-dressing of phosphates increased the carrying-capacity of the land in summer, it did not decrease the long tail of culls sufficiently to enable sheep to be profitably farmed, and that in the colder months of the year the pastures, whether top-dressed or not, were full of moss.

The Turakina and Himatangi soils shown in the table are two fertile Wellington west coast soils of very different types—one a silty loam, the other a dune-sand. Dairy-farming is successfully carried out on both types, the analyses being inserted for comparison with those of the Mairoa soils.

The writer reported regarding the Mairoa lands in December, 1926 : " From what I could see and ascertain from laboratory tests it seems that lime is required to improve the composition and texture of the soil, the lime-absorption of most of the soils being about 1 per cent., which, translated into terms of tons per acre, would, roughly speaking,

amount to about 10 tons per acre of carbonate of lime. This is, of course, an empirical laboratory test, and by no means to be taken as indicating that it would be profitable to apply such a large amount. It is extremely desirable that further investigations should be made into the best method of reclaiming this fine country, which is rapidly going back to fern. It seems quite probable that some form of calcium, which is alkaline, may prove a very strong agent in bringing this land back to its previous productive capacity."

The writer, with the idea that there was a deficiency disease, visited the district again early in 1927, and again later in the year, with Mr. J. Lyons, Director of the Live-stock Division. Under his direction post-mortems of some ill-nourished sheep were made, and the idea that parasites could be the cause of the trouble was eliminated. The hypothesis was then adopted that a deficiency disease was the cause of the failure of sheep to develop normally. It was reported by one farmer that a few sheep which had been diagnosed as suffering from deficiency disease in September, 1927, were placed on a limed paddock, where they made a quick recovery, and were sold fat a few months later. The great dearth of Leguminosæ in these pastures was brought home to one by the fact that a skilled assistant sent to take a sample of clover (red and white) on an 800-acre farm in April, 1927, returned with the report that not enough could be found to analyse!

The fact that the land had given good results for the years immediately succeeding the primary forest burn indicates that some element supplied as a result of the burn had been slowly removed from the soil by leaching out in the drainage-water of the copious rainfall. Rothamsted results show that potash and phosphates are not leached out of clay soil, but that calcium, nitrates, sulphates, and chlorides are lost in considerable quantities by leaching. Sulphur and chlorine cannot be the deficient elements in the Mairoa land, as they have been supplied freely in superphosphate and potash salts without effecting the required improvement in the stock. Nitrogen is present in large amounts as total nitrogen, so that it cannot be this element. The only element that answers all criticism is calcium, which would be supplied, it is calculated, by a forest burn in amount equal from ½ ton to 1 ton of calcium carbonate per acre. Calcium in one form or another is the largest constituent of wood-ashes; it is certainly a necessary element to success in farming these loam soils of high organic-matter content, and it would be comparatively quickly removed by leaching.

Deficiency of lime in the soil leads to deficiency of Leguminosæ in the pasture. These Leguminosæ—clovers, lotus, trefoils, medicks, and melilots—normally contain much greater amounts of lime and phosphates than do grasses, and hence a pasture containing legumes is highly desirable for sheep-farming, since a high calcium content in the pasture is much more necessary for sheep than for cattle. Deficient calcium in the pasture leads to all kinds of diseases in stock. It also probably injuriously affects the growth of bone in the animal; and it may be noted that many Mairoa sheep which have died have exhibited extraordinarily weak bones. Calcium is the chief constituent in bone ash. Dr. McIntosh states: "A ration deficient in calcium may result in phosphate starvation even when sufficient amounts are present in the food. These two elements are very closely associated in their relation to physiological and structural functions in the body."

Table 2.—Chemical Analyses of Mairoa and other Soils.

Results, except *, are percentages on soil dried at 100° C.

Sample No.	Locality.	Volatile Matter.			Total Nitrogen.	1 per Cent. Citric-acid Extract: Dyer's Method, Hall's Modification ("Available Plant-food").				Hydrochloric-acid Extract ("Total Plant-food").				Lime-requirement (per Cent. $CaCO_3$).		pH Value.
		* On Air-drying.	* At 100° C.	On Ignition.		Lime (CaO).	Magnesia (MgO).	Potash (K_2O).	Phosphoric Acid (P_2O_5).	Lime (CaO).	Magnesia (MgO).	Potash (K_2O).	Phosphoric Acid (P_2O_5).	On Air-dried Soil.	On Soil dried at 100° C.	
	Mairoa Soils.															
X 557	Topsoil, unmanured, virgin (forest) ..	..	10·3	30·1	0·830	0·228	0·041	0·032	0·008	0·74	0·38	0·14	0·03	0·80	0·89	5·8
	Unmanured soil, average of samples X 555, 559, 561, 565, 569, 573, 575	..	9·3	26·6	0·607	0·161	0·035	0·025	0·008	0·69	0·39	0·17	0·02	0·82	0·90	5·3
X 563	Taken near limestone outcrops ..	..	9·8	20·4	0·599	0·573	0·087	0·033	0·007	1·63	0·92	0·34	0·15	0·34	0·38	6·3
X 609	Composite of manured soils.. ..	..	8·3	30·1	0·720	0·203	0·041	0·034	0·018	0·51	0·51	0·34	0·08	..	..	..
	Other Soils.															
W 1377	Turakina Valley	..	3·0	11·1	0·369	0·296	0·112	0·021	0·017	1·79	1·13	0·86	0·07	0·13	0·13	..
W 1379	Himatangi	..	0·7	3·1	0·075	1·155	0·052	0·016	0·003	3·41	0·69	0·35	0·01	†	†	..

† Carbonate of lime present.

[*Analyses by F. J. A. Brogan.*

Table 3.—Chemical Analyses of Mairoa Locality Pastures.

The results are expressed as percentages of the sample dried to constant weight in water oven. Analysis performed on the ash for minerals. The insoluble silica, sand and silt was fused with carbonate of soda and the total silica determined.

Sample No.	Locality.	Date collected.	Ash.	Sand + Silica (SiO_2).	Silica (SiO_2).	Phosphoric Acid (P_2O_5).	Lime (CaO).	Magnesia (MgO).	Manganese Oxide (Mn_3O_4).	Sulphuric Anhydride (SO_3).	Total Nitrogen (N).	Manurial Treatment.	Remarks.
6006	Mairoa	10/4/27	12·18	2·13	1·97	1·13	1·20	0·61	0·028	0·92	4·20	6 cwt. super, 6 cwt. potash. No lime	Horse-paddock.
6007	Mairoa	10/4/27	12·01	1·74	1·64	1·12	1·23	0·60	0·029	1·06	4·36	1 ton lime carbonate, 4 cwt. potash, 2 cwt. super	Ram-paddock.
6018	Otanake	—/9/27	12·09	4·80	..	0·72	0·85	..	0·013	..	3·31	..	Roadside.
6019	Horopupu Road ..	—/9/27	12·24	3·68	3·47	0·87	1·08	..	0·026	..	3·08	..	Limestone outcrop near school.
6020	Otanake	—/9/27	10·44	3·12	2·90	0·70	0·59	..	0·057	..	3·37	..	Paddock No. 1, south side shelter-bush.
6021	Otanake	—/9/27	10·92	2·19	2·11	0·77	0·66	..	0·047	..	3·47	..	Paddock No. 2; away from lime-stone outcrop.
6022	Otanake	—/9/27	10·86	1·91	1·82	0·69	0·86	..	0·018	..	4·18	..	Pasture round limestone.
6023	Maungamangero ..	—/9/27	11·96	2·24	2·04	0·86	1·26	..	0·012	..	3·59	..	Around limestone.
6024	Maungamangero ..	—/9/27	10·82	1·49	1·35	0·83	0·79	..	0·028	..	3·76	..	Away from limestone.
6025	Waitungaruru ..	—/9/27	12·36	2·50	2·15	0·98	1·40	..	0·026	..	3·53	..	Grass round limestone outcrop.
8000	Mairoa	10/4/27	11·59	3·66	3·44	0·66	0·83	0·51	0·037	0·82	2·54	Unmanured, 21 years old	Yorkshire fog, Chewings fescue, danthonia, catsear, capeweed, piripiri, plantain, &c.

[*Analyses by B. C. Aston and I. Cunningham.*

A growing hogget requires 0·0093 lb. of calcium oxide a day (Wilson), and 100 lb. dry matter of the worst Mairoa pasture in summer contains, say, 0·7 lb. calcium. A hogget, even at its maximum capacity, would eat not more than 3 lb. of dry matter a day, or, say, 0·021 lb. calcium oxide, but at its minimum capacity probably not more than one-half to two-thirds of this. When it is remembered that, of the mineral food ingested, only one-third to one-half is capable of being digested, it will be seen that there is no margin to work on. In addition, in winter the calcium content is probably considerably lowered. The case of the milking-ewe in her demand for calcium is far worse than that of the hogget, for she requires 0·020 lb. calcium oxide daily, and if her ingested food contains about 0·021 lb. calcium oxide there is no margin to allow for calcium not digestible, or for the lowered content of calcium in the pasture due to seasonal change. Wilson also states: "In general, lime is the critical mineral, if not the critical food ingredient for sheep. . . . In poor pastures—*i.e.*, pastures containing no clovers—sheep are very short of lime."

It is not intended to overload this article with technical analysis either of soils or of pastures, but the writer will be glad to supply fuller information to any inquirer. The results show that where the pasture is limed or manured the calcium-oxide (lime) content is about twice as much as on the untreated pasture, whereas the disparity in the phosphate is not nearly so great. There is, however, very great difficulty in obtaining samples of what the sheep are actually eating, so that practical experiments in the field provide the only method of obtaining convincing results.

There is good evidence that sheep will improve on limed land in greater degree than on land which has been merely treated with phosphates; also that they prefer the herbage growing on the limed land, and that a lime dressing alone effects a very great improvement in poor and deteriorated pasture, inducing a growth of white clover which could not be detected on unlimed adjacent land.

The fact that the lime-requirement figure shows an absorption of calcium carbonate approximately equal to 10 tons per acre of ground limestone has been advanced as a reason for abandoning the Mairoa lands, since no one could afford to apply this quantity of lime. It is not, however, necessary to satisfy the high lime-requirement of 10 tons per acre; in fact, the full lime-requirement never is satisfied, even when it is, as in the majority of North Island soils, only in the vicinity of 2 to 4 tons per acre.

There are several methods which might be tried with the object of avoiding the great expense of liming, under the present conditions, large tracts of hill country. These fall under different headings:—

(1) Cheapening of lime—(*a*) By having local grinding plants for reducing limestone to powder; (*b*) by having local kilns for "burning" limestone; (*c*) by broadening the scope of the existing Government subsidy on the transport of lime.

(2) Feeding pellets or licks containing calcium in some available form.

(3) Bringing up the calcium content of the pasture on one paddock on each farm, and running the entire stock periodically on that particular paddock.

(4) Using deep-rooted legumes, such as lucerne, which if they could be established would provide a fodder with a high lime content.

SUMMARIZED INDICATIONS OF LIME-DEFICIENCY.

A number of field experiments are being carried out under the charge of the country analyst (Mr. C. M. Wright), attached to the Mineral Content of Pastures Investigation, to determine various points connected with these deteriorated lands. For the present it may be said that the following points all indicate that lime in some form is urgently needed for the loam soils similar to those analysed on which sheep refuse to develop normally :—

(1) Excessively high lime-requirement, and other laboratory tests denoting soil acidity.

(2) Non-success with phosphates and potash salts in eliminating the malnutrition which often shows itself in bone-weakness.

(3) Presence of club-root disease in cruciferous crops (which is checked by liming the land).

(4) Presence of sufficient available phosphate in the soil shown by chemical analysis.

(5) Excessive moss in the pasture, especially in the winter.

(6) Good results obtained by local farmers with wood-ashes, and the good results from the pastures established for the first eight years after a burn.

(7) Absence of clovers and other legumes in the pastures in spite of abundance of potash in the soil.

(8) Presence and great activity of worms on the limed compared with the unlimed pasture.

(9) Weakness of the bones of dead animals.

(10) Difference in the chemical analysis of the soils of fertile farms as compared with those of the deteriorated lands in the same district.

(11) Botanical composition of the unlimed pastures, which show much moss, Yorkshire fog, brown-top, danthonia, and species which love sour soils.

(12) Difference in the chemical analysis of the pasture on limed land compared with that on unlimed land.

(13) Preference of sheep specially, and stock generally, for limed pasture over unlimed pasture, even when liberally phosphated ; and the improvement in the health of sheep when transferred to limed pasture.

(14) High organic-matter content of all the soils analysed.

Export of Stud Stock.—Exportations of stud stock from New Zealand during the year ended 31st March, 1928, comprised 6,287 sheep, 184 cattle, and 13 draught horses. In addition a number of thoroughbred and trotting horses were shipped to Australia, mainly for racing purposes.

POTATO-CULTURE.

DESCRIPTIONS OF SOME OF THE MORE IMPORTANT VARIETIES.

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THE descriptions of potatoes here given are those of varieties most commonly grown in New Zealand, most of which are eligible for inspection under the Government certification of seed-potatoes system. The descriptions are intended to be used in the hands of potato-growers, merchants, and seedsmen, and have been kept as simple as possible, although it must be confessed that this virtue may have resulted in some of the descriptions being rather indefinite. It is almost certain that there are some minor inaccuracies, which will be corrected as more investigation work is carried out. There exists, however, so much confusion, and the need for some definite system of nomenclature is so urgent (more especially in view of the introduction of certification) that the writer feels there is full justification for the publication of such information as is available at the present time. The effort will not have been in vain if it stimulates growers and merchants to take an active interest in the attempt now being made to create order out of the present disorder, and this can be accomplished only if those interested will assist.

The writer would welcome any criticism or information which may assist in correctly "placing" each variety of commercial importance. In fact, this matter is published as much with a view to collecting as of imparting information.

Scheme of Varietal Descriptions.

In describing varieties it is necessary to use certain terms, which must be understood clearly before the reader can make full use of the descriptions. The writer has made free use of information available from works by Salaman*, McIntosh†, Stuart‡, and the various publications issued by the Board of Agriculture for Scotland.

The following terms are used in the descriptions :—

HABIT.

"Habit" refers to the general appearance of the growing plant. It is the mental picture which is of such great value in identification and yet so difficult to describe.

(*a*) *Height* when grown under normal conditions: Tall, 2 ft. or over; medium, 18 in. to 2 ft.; short, below 18 in.

(*b*) *Type of growth* may be "upright" or "spreading."

(*c*) *Vigour* may be described as "strong," "medium," or "poor."

(*d*) *Open or compact growth:* "Open" when the stems can be seen distinctly through the leaves; "compact" when the foliage is so dense that the stems are not easily observed.

* "Potato Varieties," R. N. Salaman, M.D., Cambridge University Press.
† "The Potato," Thomas P. McIntosh, B.Sc., Board of Agriculture, Scotland.
‡ "The Potato," William Stuart, U.S.A. Department of Agriculture.

STEM.

(*a*) *Wings* may be waved or straight. The wings are easily observed, running the length of the stem, and assist to exaggerate the characteristically triangular shape of the cross-section of the stem. The observations should be limited to the upper two or three internodes of the stem.

(*b*) *Colour.*—It is very rarely that a stem is totally devoid of colour, and the amount present, although liable to modification according to the amount of light, is a valuable aid in identification. The writer has for some years used the figures 1 to 10 as an index to coloration, but, since discovering that Dr. Salaman uses the figures 1 to 4, has adopted this method in the descriptions which follow. Colour 1 would indicate slight coloration, more especially about the ground-level. In Colour 4 the concentration would be so great as to make the stem a deep red-purple. This degree of coloration is very rare, and would almost certainly extend to the midrib of the leaf and leaflets and the flower-stalk.

LEAF.

The potato has a compound leaf consisting of a number of leaflets. Certain variations are exhibited which afford valuable aids to identification. The colour, for example, is described as light, medium, or dark green, although the presence of mosaic may very materially affect this characteristic.

INFLORESCENCE.

(*a*) *The trusses* of flowers may be prominent or inconspicuous, depending upon the length of the flower-stalk. (*b*) *The flowers* themselves may be numerous, scanty, or rare. (*c*) *Flower-colour* is an important varietal characteristic, but one that is modified by hot weather or intense sunlight, and should be taken from a freshly opened flower. Flowers may be white or coloured. Coloured flowers are here described as being red-heliotrope, blue-heliotrope, and pure blue.

TUBER CHARACTERISTICS.

Where potatoes are bought and sold without any field inspections the tuber affords the only means of identification. Its value for this purpose is greatly exaggerated by merchants, seedsmen, and growers, for the tuber is subject to considerably more modification from environment than any other part of the plant. Moreover, the differences, which may be very apparent to one who has handled potatoes for many years, are often difficult if not impossible to describe.

(*a*) *Skin.*—This may be described as smooth (Fig. 8), rough (Fig. 1), russet (Fig. 14), or scaled (Fig. 13).

(*b*) *Colour.*—White potatoes offer a wide variation of shades, depending largely upon the thickness of cork layers of the skin. Bresee's Prolific, although classed as white, is in reality a very pale pink or flesh colour. This can be best observed on an immature tuber, and is intensified on exposure to light, which is also the case with Epicure. Coloured potatoes may be self-coloured or the colour may be unevenly distributed. The distribution of the pigment may be around the eyes, as in King Edward, or it may spread over the intervening spaces, leaving the skin

around the eye without colour, as in Pink Beauty of Hebron. The colours are here described as white, pink (pale red), red, light purple, and deep purple.

(*c*) *Shape.*—It is extremely difficult to describe shape correctly. The characteristic is modified by soil and rainfall, and in a dry soil the tuber will tend to be shorter than normal. A tuber has a rose end and a heel end, the latter being that end nearest the point of attachment to the parent plant. On holding a tuber with the rose end down there will be seen a distinct brow surmounting the eye. In most tubers there is a distinct upper and lower surface. The upper surface is often rounded and carries most of the eyes, the lower surface is often flat, or even concave. On placing a tuber flat side down the lateral contour can be observed. Classification according to shape offers considerable difficulties. In these notes the apparent shape is described as round, long, kidney, or oval.*

Round: Such tubers are as long as they are broad in contour, but may be more or less flattened (Fig. 12). There is nearly always a depression at the heel end (Fig. 10).

Long: Potatoes of this type may be either finger-shaped or cylindrical. In cross-section they are round. The finger-shaped is tapering and often hooked at the heel end, as in Black Kidney. The cylindrical type is of more or less equal diameter throughout its length—that is, the sides are parallel (Fig. 3).

Kidney: The kidney is described as long with elliptical ends (Fig. 17). It does not necessarily have any lateral depression such as the name would suggest, and as is depicted in Fig. 23.

Oval: This merely describes a short kidney (Fig. 13).

Flesh Colour.—This is described here as white, intermediate, or yellow. Salaman has shown that genetically there are two types—the yellow (as in Leader) and white (as in Dakota). The intermediates are heterozygous, resulting from white × yellow. In addition, the flesh may contain the pigment present in the skin, but in commercial varieties this is confined to the vascular tissue.

Eyes.—(*a*) These may be deep (Fig. 1), medium (Fig. 5), or shallow (Fig. 13). (*b*) They may be evenly distributed (Fig. 2) or mainly at the rose end (Fig. 14A). (*c*) The colour of the eyes and the skin surrounding the eye is a valuable aid in identification, and is most easily observed in the immature tuber. Northern Star has a characteristic "picked eye," the colour being much deeper than that in Bresee's Prolific.

Sprouts.—A great deal of importance is attached to the sprout as a means of identifying rogues, and it is equally valuable as a means of identifying degenerate tubers. In these notes the sprouts are described as pink, deep pink, and blue.

MATURITY.

The terms used in this connection are "first early," "second early," "early main crop," and "late main crop."

* It is of interest to note in this connection that Dr. Salaman has demonstrated the existence of only three genetic types—the round, the kidney, and the long. Of these, the kidney (which includes the ovals) is the heterozygous or hybrid form resulting from long × round. He points out that true rounds are uncommon in commerce, and has proved that some varieties which appear to be round are not in reality so, for on "selfing" they break up, giving rise to the Mendelian ratio of 3 long to 1 round.

SUMMARY.

Each variety has been dealt with on the following plan :—

Origin : Raiser's name, and parentage of variety.

Habit : Vigour—Strong, moderate, weak.
Height—Tall, medium, short.
Foliage—Open, medium, dense.
Growth—Upright, spreading.

Stem : Wings—Waved, straight.
Colour—1–4.

Leaf : Colour—Dark, medium, light green.

Inflorescence : Tall and prominent, medium height, short and inconspicuous.
Flowers—Numerous, scanty, rare.
Colour—White, red-purple, blue-purple, blue.

Tuber : Shape—Long (spindle or curved), kidney, oval, round, flattened, tapering (pear-shape).
Colour—White, pink (pale red), red, light purple, deep purple. Self-coloured, splashed.
Skin—Smooth, rough, russet, scaled.
Flesh colour—Yellow, intermediate, white, pigmented.
Eyes—Deep, medium, shallow. Distributed evenly or mainly at rose end. Eyes picked.
Sprouts—Pink, deep pink (pink and carmine), blue.

Maturity : First early, second early, early main crop, late main crop.

Classification of the Hebron Group.

If an attempt were made to group varieties there would be a degree of similarity in type between Dakota, Early Rose, Pink Beauty of Hebron, New Zealand White Beauty of Hebron, Early Puritan, Endurance, and, finally, White Elephant. The correct nomenclature of the varieties here grouped together will entail some years of investigation. Such information as is available is given with a full appreciation of the fact that it may be liable to correction when more light is thrown on to the subject. The position is very complicated, not only through mis-naming but because some of these varieties have during the last fifty or sixty years thrown a number of sports, bolters, and wildings. In this country there appear to be the following recognized varieties of the group :—

Dakota.—This variety stands out as being quite distinct, although within the variety there seems to be considerable variation in foliage, which is possibly due to virus disease. The large proportion of Early Rose and Beauty of Hebron rogues present in commercial crops is sufficient indication of the similarity of these varieties.

Early Rose may be considered distinct, and is discussed under its type description.

Beauty of Hebron (Pink) is probably what is referred to in American writings as "Beauty of Hebron," and is described fully elsewhere. Stuart describes four variations of Beauty of Hebron.

White Beauty of Hebron as grown in this country does not appear to be true American White Beauty of Hebron, but rather than change a name in common usage the local variety will be referred to as New Zealand White Beauty of Hebron. The true White Beauty of Hebron is synonymous with Early Puritan, the skin of which is quite white. The skin of New Zealand Beauty of Hebron is creamy-white splashed with pink, and appears identical with the American White Elephant and Late Beauty of Hebron.

Early Puritan is identical with the true American White Beauty of Hebron, and will be referred to always as Early Puritan.

Endurance.—No record can be found of a variety of this name outside New Zealand. Its similarity to the other members of the Hebron group would suggest that it may be an American variety introduced and renamed.

White Elephant.—The tubers of this variety are very similar to Endurance except that they are larger and coarser. The foliage is that of the Hebron group, but the coloration on the heel end and in the sprouts is purple and the flowers blue. The variety is apparently quite distinct from the American White Elephant and Late Beauty of Hebron, and will therefore be referred to as New Zealand White Elephant.

Gold Coin is quite distinct, but is included in this group on account of tuber resemblance. Stuart places Gold Coin in the Green Mountain class, and the Scottish Board of Agriculture records it as being of the Up-to-Date class.

Finally, there is a rogue common in Dakota, Early Rose, and Beauty of Hebron, the tubers of which are flat and oval, eyes shallow, and skin smooth and of a deeper pink than Early Rose. Its most striking characteristics is the low-spreading haulm giving the appearance of a flat top, broad pale-green leaflets, and total absence of flowers. It is much earlier than any of the foregoing varieties of the group, and appears to tally with the American variety Early Ohio.

DAKOTA.

Origin.—Produced in America in 1883.

Habit.—Tall, vigorous, moderately open growth.

Stems.—Wings waved. Colour 2, extending to flower-stalk and leaf-midrib.

Leaves.—Medium green.

Inflorescence.—Tall and prominent; flower-stalk coloured. Flowers white. moderately numerous.

Tuber.—Oval, flattened, tapering to rose end and deeply notched at heel end. Flesh pure-white, crisp, with sometimes a little colouring near rose end, especially in immature tubers. Eyes very deep and evenly distributed. Skin rough and red in colour. Sprouts deep pink.

Maturity.—Late main crop.

NOTES.—Probably the most valuable red potato grown in this country, on account of its excellent keeping and cooking qualities, and its ability to crop well on the warm light land of mid-Canterbury. Popularity has waned owing to the stocks being impure and containing a proportion of yellow-fleshed Leader (Fig. 4) and other varieties. It still commands a premium to growers of 15–20 per cent. above the price of other varieties grown in Canterbury.

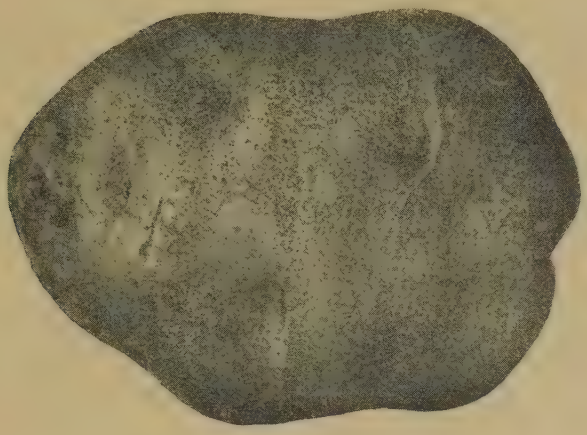


FIG. 1. DAKOTA.

EARLY ROSE.

Origin.—A seedling of Garnet Chili, raised in America in 1861, and introduced into commerce in 1867.

Habit.—Medium vigour and height. Moderately dense and spreading.

Stem.—Wings moderately waved. Colour 1.

Leaf.—Medium to dark green.

Inflorescence.—Tall and prominent. Flowers white and numerous, more profuse than Beauty of Hebron.

Tuber.—Long spindle-shaped; often flattened and notched at heel end. Skin pink, moderately smooth; that at the rose end often a deeper pink and rough or netted. Eyes moderately deep and evenly distributed. There is no variation in colour around the eyes as can be observed in a freshly dug Beauty of Hebron. Sprouts deeper pink than Beauty of Hebron, and may be described as rose-lilac. Flesh, white and pigmented red. (Compare with Beauty of Hebron.)

Maturity.—Second early.

NOTES.—Probably no pure crops available. This variety has played an important part in the history of potato improvement, and is regarded as the fountain-head of present-day varieties.

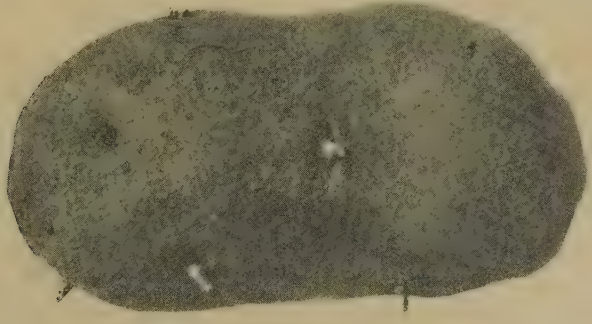


FIG. 2. EARLY ROSE.

BEAUTY OF HEBRON (PINK).

Origin.—Raised in America from a seedling of Garnet Chili in 1878, and introduced into commerce by Peter Henderson of New York.

Habit.—Medium vigour and height. Moderately dense and spreading.

Stem.—Wings moderately straight. Colour 1.

Leaf.—Medium to dark green.

Inflorescence.—Tall and prominent, and no colour in flower-stalk (compare with Dakota). Flowers, white and numerous.

Tuber.—Long spindle-shaped, often flattened and notched at heel end. Skin, pink and moderately smooth. The skin around the eyes of a freshly-dug tuber is creamy-white. Eyes moderately deep and evenly distributed. Sprouts pale pink. Flesh, white. (Compare with Early Rose.)

Maturity.—Second early.

NOTES.—This variety is extremely difficult to distinguish from Early Rose. Few if any pure crops are available, most lines being a mixture with Early Rose. It is a common impurity in the Dakota, from which it can be distinguished by its more prominent inflorescence and the green flower-stalks. A useful variety for the garden. The Southern commercial crops are mainly grown for the North Island seed trade. Very susceptible to late blight.

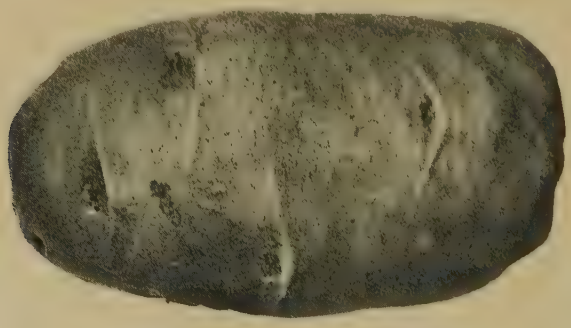


FIG. 3. BEAUTY OF HEBRON (PINK).

NEW ZEALAND WHITE BEAUTY OF HEBRON.

Origin.—This variety is distinct from the true American White Beauty of Hebron, and probably is identical with White Elephant or late Beauty of Hebron, in which case it originated from a cross between Garnet Chili and White Peachblow, and was introduced into commerce in America in 1881.

Habit.—Vigorous, tall, and open.

Stems.—Numerous side branches, wings waved. Colour 1.

Leaf.—Leaflets small and pale green.

Inflorescence.—Moderately prominent. Flowers white and not very numerous.

Tuber.—Long spindle-shaped, very variable, usually pointed at both ends. Skin creamy-white, splashed with variable amount of pink colouring which avoids the eyes; skin smooth. Eyes medium depth. Sprouts pink. Flesh, white and crisp.

Maturity.—Early main crop.

NOTES.—A satisfactory garden variety, but too brittle for market. Very liable to late blight. Wildings occur. There exists a great variation in shape and foliage due probably to the spread of wildings and the disease known as spindle tuber. There is even greater variation in colour, which ranges from almost pure creamy-white to the normal coloration of Pink Beauty. When reproduced from tubers these variants seem to retain the characteristic of the parent plant, and the possibility is that they represent a large number of mutants or sports arising during the last forty years.

EARLY PURITAN.

Origin.—Said to be a seedling of Beauty of Hebron, and introduced into commerce in America in 1888. It is synonymous with the true American White Beauty of Hebron, but not with the New Zealand White Beauty of Hebron (which see).

Habit.—Medium height and vigour; spreading and medium to dense foliage.

Stem.—Wings slightly waved. Colour 1.

Leaf.—Medium, green and glossy; secondary leaflets very small.

Inflorescence.—Prominent. Flowers white and fairly numerous.

Tuber.—Oval, pointed and often flat at heel end. Skin white and smooth. Eyes medium to deep with long and prominent eyebrows. Sprouts very pale pink. Flesh, white.

Maturity.—First early to second early.

NOTES.—Very subject to disease, particularly late blight. Excellent cooking and keeping quality, and at one time very popular. As a result other varieties are sold under this name, and very large areas of Bresee's Prolific are grown and sold as Early Puritans.

FIG. 4. LEADER, A YELLOW-FLESHED VARIETY FOUND AS AN INNOVATION IN MAINE POTATO CROPS.

ENDURANCE.

Origin.—Not known. Probably an American variety received in this country.

Habit.—Of moderate vigour and height; upright and open.

Stem.—Wings distinctly waved. Colour 1.

Leaf.—Small, crinkled, and medium green.

Inflorescence.—Tall. Flowers white, occasional in numbers.

Tuber.—Large, and somewhat inclined to be russetted; oval to kidney (long oval), often flattened at heel end and pointed. Skin white, moderately smooth, sometimes flaked. Flesh white and crisp. Eyes medium to deep and evenly distributed. Sprouts pink. Tubers similar in appearance to New Zealand White Elephant, except they are not as coarse and misshapen and show no colour at heel end.

Maturity.—Early main crop.

NOTES.—A valuable variety for light land, though very liable to late blight. Flesh is so brittle when crop newly dug as to render variety not suitable for chipping. Cooking and keeping qualities excellent.

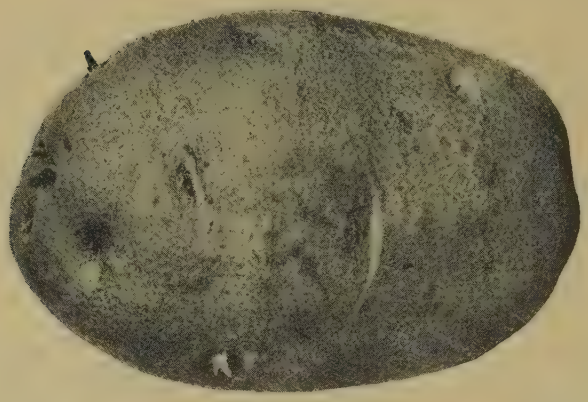


FIG. 5. ENDURANCE.

NEW ZEALAND WHITE ELEPHANT.

Origin.—Not known. Distinct from American White Elephant. (See New Zealand White Beauty of Hebron.)

Habit.—Tall, vigorous, upright, and open.

Stem.—Wings large and waved, and mottled purple. Colour 2, extending to midrib of leaf and flower-stalk. Much branched.

Leaf.—Pale green; small leaflets.

Inflorescence.—Not prominent. Flowers blue, occasional, and fall early or before opening. Calyx tinged red-purple.

Tuber.—Oval, often flattened at heel end and notched. Shape irregular, and much second growth. Eyes very deep, and large bump above the eyes. Skin medium to smooth. Colour white, with tinge of purple on stolon and at heel end of tuber if examined when freshly dug. Sprouts blue. Flesh white. Tubers very similar in appearance to those of Endurance, except that they are coarser and more misshapen.

Maturity.—Late main crop.

NOTES.—Synonymous with Australian Snowflake. Crops heavily on moist rich land, but not popular, on account of the large, coarse, misshapen tubers. It is an excellent table potato, and keeps well if late blight is absent. It will not stand transport, being very brittle when freshly dug. This variety is much disliked in commerce, and is invariably rejected for the North Island trade by port graders acting under instructions from the merchants' associations.

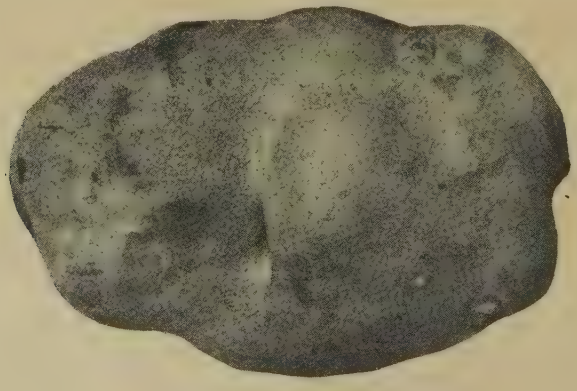


FIG. 6. NEW ZEALAND WHITE ELEPHANT.

GOLD COIN.

Origin.—American origin. Introduced into commerce about 1903.

Habit.—Medium vigour and height. Spreading, rigid, and open.

Stem.—Contains no colour.

Leaf.—Medium green ; leaflets small.

Inflorescence.—Inconspicuous. Flowers white, very rare ; buds green, mainly drop off. Flower-stalk green ; stamens orange.

Tuber.—Large, long oval to kidney flattened. Skin light creamy-brown, smooth to rough. Flesh white. Eyes moderately deep. Sprouts creamy-white, no colour observed.

NOTES.—An excellent potato, requiring good land, but very susceptible to late blight.

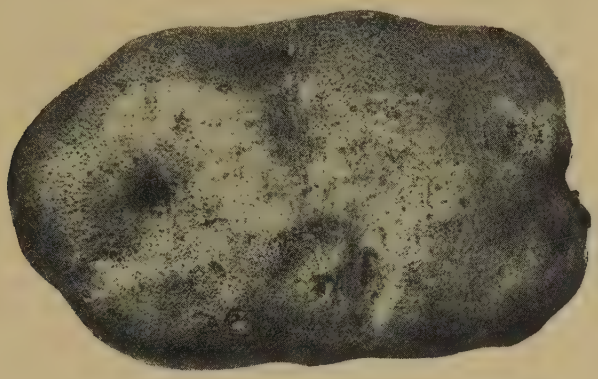


FIG. 7. GOLD COIN.

(To be continued.)

CARELESS DIPPING OF SHEEP.

THE following remarks on this matter are made by the Director of the Live-stock Division, Mr. J. Lyons, M.R.C.V.S., in his annual report for 1927–28 :—

From all parts of New Zealand reports have come to hand indicating that sheep are being dipped in a careless manner, and that the dips have not answered the purpose for which they were intended—namely, freeing from lice. Under such circumstances sheepowners invariably blame the dips as being ineffective. I am satisfied that in a large majority of cases it is not the dip that is at fault, but the manner in which it is mixed or dissolved. There are numbers of dips on the market that, when properly mixed with soft water in a bath that has been thoroughly cleaned, will do excellent work in freeing the sheep from lice and ticks. If sheepowners would see that this is done, fewer complaints would be made with reference to the ineffectiveness of dips. From the Canterbury districts reports were received that a considerable amount of mortality had been observed in a number of farms amongst sheep that had been recently dipped. Again the dipping-fluid was blamed. On investigation, however, it was found that it was the first mixing of the dip for the season in these cases, and the first sheep that were put through the dip were the ones to suffer. On post-mortem examination it was found that the sheep had died from inflammation of the lungs, and, in some instances, the stomach and intestines, thus clearly showing that the dip had not been thoroughly mixed, and that some of the poisonous material was floating on the top of the water and had been swallowed by the sheep. With such mixing, even if material is not swallowed, there is always a liability of the sheep becoming scalded. It is to the interest of all sheepowners to see that the dip is mixed satisfactorily.

OFFICIAL HERD-TESTING OF PUREBRED DAIRY COWS.

SURVEY OF THE FIRST SEASON'S WORK, 1927–28.

W. M. SINGLETON, Director of the Dairy Division, Wellington.

THE Official Herd-test* has now completed its first year of operation, and an examination of the year's results reveals some interesting features. The support accorded the scheme has been gratifying, and sufficient to signify that it has met with the approval of the majority of our Certificate-of-Record testing breeders. All new ventures experience a share of adverse criticism, and constructive criticism is always appreciated. It is pleasing to be able to state that breeders as a whole have found very little fault with the O.H.T. rules, and that some have submitted suggestions of a helpful nature.

At the height of the 1927–28 season the number of cows on official herd-test was approximately 1,550. For summarizing purposes, however, it has been found necessary to consider the 31st July, 1928, as the close of the season, all cows which had completed their 305-day test at that date, or had been previously dried off or withdrawn, being included in the summary. Needless to say, however, some later-calving cows had not completed their testing-period at that date, and consequently are omitted from this survey.

From a summarizing point of view the official herd-testing presents much the same difficulties as the ordinary herd-testing, inasmuch as cows are withdrawn at varying stages of the lactation period of ten months permitted by the rules governing the test. C.O.R. cows are, of course, classified on the basis of certificates gained, but with the O.H.T. there are no requirements in this connection. A study of the year's results suggests that a classification on the basis of all cows on test six months—180 days or more—is perhaps most fairly representative of the position, and this demarcation has therefore been adopted as the principal basis for summarizing.

As persons interested in the O.H.T. are aware, the system is, broadly speaking, confined to registered purebred dairy cows. In one or two instances, however, and subject to special circumstances, the O.H.T. has been extended to the testing of a few cows other than registered purebreds. In the accompanying tables cows other than purebreds have been omitted. It may be stated for general information, however, that eighty-seven grade cows were included in the herds on which this summary is compiled.

Table 1, which is computed on the basis of all cows on test 180 days or more, and, as with all tables in this survey, is complete to 31st July, 1928, provides an indication of the general position regarding the number of O.H.T. cows tested during the season.

In connection with this table it may be mentioned that although the total number of cows tested appears as 1,127, there were 133 cows withdrawn or finished up prior to the 180 days, thus making a total

* Particulars of the O.H.T. were given in the *Journal* for July, 1927, under the heading of "The Official Herd-test: An Adjunct of the C.O.R. System."

of 1,260 cows. Had this table been based on cows on test 100 days or more the number would have been 1,207, indicating that 80 cows dropped out between 100 and 180 days. On the other hand, some 164 cows had not concluded their testing-period at 31st July and some 126 grades have also to be considered, so that the maximum number of cows on test in any one month during the year was, as previously stated, about 1,550.

Table 1.

Breed.	Number of Breeders.	Number of Cows.
Jersey	73	605
Friesian	20	376
Ayrshire	2	65
Milking Shorthorn	5	53
Red Poll	2	28
Totals	102	1,127

Table 2, which also includes all cows tested 180 days or more during the period under review, shows the average production for each breed, and for all cows combined.

This table is self-explanatory, but some interesting comparisons are provided by certain other figures which have been taken out. An average compiled on the 100-day basis, as used for ordinary dairy-herd testing, gives a result of 274·42 lb. butterfat in 259 days, which compares favourably with an average yield of 240·48 lb. in 236 days for all cows on herd-test in New Zealand in 1926–27. Then again, if the O.H.T. cows are summarized to include only those which milked seven months or more, it is found that the average yield is 290·23 lb. butterfat. While the O.H.T. average yield may not be as high as some have expected, the fact must not be lost sight of that the system has been made use of to try out untested cows rather than animals specially selected for the purpose of making high records. Moreover, the shortness of the average lactation period must also be borne in mind. The average C.O.R. cow in 1927 gave 469·56 lb. butterfat.

Table 2.

Breed.	Number of Cows.	Average Yield for Season.		
		Average Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Jersey	605	274	5,709·9	305·79
Friesian	376	263	7,526·8	264·29
Ayrshire	65	253	5,712·6	232·02
Milking Shorthorn	53	252	5,646·9	228·64
Red Poll	28	283	6,254·1	267·18
All cows	1,127	268	6,326·8	283·10

In Table 3 are given particulars of the highest and lowest individual herd yields within each breed. This table is also based on the 180-day minimum.

Table 3.

Breed.	Highest Herd.			Lowest Herd.		
	Number of Cows.	Average Days.	Average Butterfat.	Number of Cows.	Average Days.	Average Butterfat.
			lb.			lb.
Jersey	4	305	514·71	2	257	197·79
Friesian	16	290	361·33	38	220	192·65
Ayrshire	27	265	255·39	38	245	215·41
Milking Shorthorn ..	6	283	288·87	5	219	205·62
Red Poll	24	285	277·13	4	268	207·45

It will be observed that the margin between the highest and lowest average yields is in most instances considerable, but it will also be apparent that where the differences are most marked the actual average yield variation is largely accounted for by the difference in average days on test. It may be mentioned that the highest Friesian herd included is that of the Agriculture Department's Central Development Farm, at Weraroa. The highest Red Poll herd is also that of the same farm.

Table 4 summarizes the highest and lowest individual cow for each breed.

Table 4.

Breed.	Highest Cow.		Lowest Cow.	
	Days.	Butterfat.	Days.	Butterfat.
		lb.		lb.
Jersey	305	603·60	211	95·03
Friesian	305	560·53	194	106·94
Ayrshire	305	398·79	225	107·84
Milking Shorthorn	305	419·29	199	120·68
Red Poll	305	447·52	254	144·82

When the length of lactation period is taken into consideration it must be admitted that this table records some creditable yields. In fairness it should be stated that the lowest yields for the Friesian, Milking Shorthorn, and Ayrshire breeds were two-year-olds. Nevertheless, despite this fact, the yields show considerable room for improvement. It may also be mentioned that the leading cows for the Friesian and Red Poll breeds are from the Central Development Farm.

Table 5 provides a more detailed classification of production. In this tabulation the various breeds participating in the O.H.T. are subdivided according to age.

Table 5.

Class.	Number of Cows.	Average Days in Milk.	Average Yield for Season.	
			Milk.	Butterfat.
			lb.	lb.
Jersey.				
Two-year-old and under ..	219	275	5,094·8	274·32
Three-year-old	117	273	5,914·5	322·34
Four-year-old	97	277	6,206·1	331·85
Mature	172	270	6,062·5	319·23
Friesian.				
Two-year-old and under ..	121	257	6,005·1	213·78
Three-year-old	73	261	7,586·2	260·87
Four-year-old	58	272	8,363·2	292·79
Mature	124	268	8,609·7	302·24
Ayrshire.				
Two-year-old and under ..	24	235	4,192·9	169·70
Three-year-old	15	258	6,061·5	234·57
Four-year-old	6	243	6,009·0	243·07
Mature	20	274	7,435·5	301·56
Milking Shorthorn.				
Two-year-old and under ..	25	252	4,589·2	191·39
Three-year-old	6	255	6,890·2	280·86
Four-year-old	4	257	6,961·1	284·56
Mature	18	252	6,359·5	250·56
Red Poll.				
Two-year-old and under ..	3	281	5,233·4	225·04
Three-year-old	8	280	5,372·3	230·51
Four-year-old	4	296	6,604·8	274·44
Mature	13	281	6,924·5	297·23

This table reveals features common to most classifications of the kind. For instance, the most heavily represented classes are the two-year-old and the mature. Then, again, the four-year-old class is in all cases a weak one numerically. It will be observed that with the majority of the breeds the production trend from the lowest-age class to the highest is a normal one, although the Jerseys and the Milking Shorthorns are exceptions. With each of the latter breeds the production for the average mature cow is lower than that for the average four-year-old. In the Milking Shorthorns the three-year-old and four-year-old classes are sparsely represented, and possibly the influence of individual records is considerable. This, however, can scarcely apply to the Jerseys, and there is no apparent explanation beyond the fact that the mature class appears to have been a somewhat weak one in comparison with the other classes for this breed.

Table 6 supplies an analysis of production for all breeds and for all cows tested 180 days or more. This analysis has been compiled in production groups of 50 lb. butterfat, and ranges from the lowest individual yield to the highest.

Table 6.

Breed.	50 to 100.	100 to 150.	150 to 200.	200 to 250.	250 to 300.	300 to 350.	350 to 400.	400 to 450.	450 to 500.	500 to 550.	550 to 600.	600 to 650.	Total for Breed.
Jersey	2	11	44	84	153	147	92	49	13	6	3	1	605
Friesian	..	28	59	82	86	63	38	16	3	1	..	..	376
Ayrshire	..	13	13	11	15	11	2	..	..	..	..	..	65
Milking Shorthorn ..	..	5	16	11	13	6	1	1	..	..	..	..	53
Red Poll	..	1	3	6	11	5	1	1	..	..	..	..	28
Total, all cows	2	58	135	194	278	232	134	67	16	7	3	1	1,127

This table is an important one, because it indicates clearly where the cows which are lowering the average lie. As is to be expected, the most heavily represented classes are those round about the average yield, and particularly where the average itself falls. One or two interesting comparisons are relevant here. In the first place, if we take for a basis the production of the average New Zealand cow for last year—namely, 200 lb. butterfat—we find that 932 of the cows under review equalled or exceeded that production. Moving a step further, and taking as a basis last year's average ordinary herd-tested cow, with 240·48 lb. butterfat,* we find that over 800 of these O.H.T. cows exceeded that yield.

The highest number of cows placed under O.H.T. in any one herd was fifty-nine; the lowest, one. For the period under review there were altogether one hundred and eight herds on official herd-test out of a maximum of approximately two hundred on certificate-of-record test. At the peak of the year there was an average of 3·2 C.O.R. cows per C.O.R. breeder, as compared with 3·4 for the previous year, so that, when all influencing factors are taken into consideration, the O.H.T. apparently has not adversely affected C.O.R. entries.

We are now launched on the 1928–29 season, and prospects for O.H.T. entries are satisfactory. Breeders appear to be realizing that this system has been instituted for their benefit, and that it must ultimately result in improvement of our dairy herds.

* See *Journal* for October, 1927, page 215.

Foot-rot in Sheep.—The District Superintendent, Live-stock Division, Christchurch (Mr. J. Kerrigan, M.R.C.V.S.), reports a considerable occurrence of foot-rot among sheep in Canterbury during the past season. He attributes this to the lengthy spell of humid weather conditions experienced, together with a great growth of soft pasturage. Under such circumstances he advises farmers to anticipate the trouble and to take preventive measures by giving the sheep a foot-bath of one of the prescribed solutions, or by running them through a gateway where some slaked burnt lime has been placed.

UNTHRIFTINESS AND MORTALITY AMONG LAMBS AND HOGGETS.

THE PAST SEASON'S EXPERIENCE IN CANTERBURY.

J. KERRIGAN, M.R.C.V.S., District Superintendent, Live-stock Division, Christchurch.

THE past season proved an anxious one for many of the producers of fat lambs and owners of hoggets in Canterbury, and it is understood that this was more or less the case in some other parts of the South Island. The lambing throughout Canterbury was, in general, a good one, and there was every expectation that the fat lambs coming forward to the freezing-works would exceed the usual number, especially during the early months of the killing season. These expectations were not realized. The experience of most of the Canterbury works was that from January to the end of April, and probably well into May, the fat lambs did not come forward as freely as usual; moreover, that many lines were not in the usual good condition and contained a large number of second-class carcasses and a larger proportion of rejects than normally.

Many farmers experienced difficulty in fattening their lambs; consequently many lambs that were tending to go back in condition were sold and sent to the works. Fortunately, good prices were ruling and there was a demand for light lambs, which saved producers suffering as great a monetary loss as might have been the case. In one district, where a large area of the soil is of a clayey nature, many of the farmers were able to get only about 50 per cent. of their usual number of fat lambs ready for the works.

About the end of March several sheep-farmers mentioned to me that their lambs and hoggets were not thriving—in fact, that they were going back in condition and odd ones were dying. Owing to the prevailing weather conditions I was anticipating some such trouble, and advised them, if possible, to give their lambs and hoggets a change on to land where the feed was inclined to be dry, and to assist them by giving some crushed oats mixed in chaff or some good hay, &c. At a later date these farmers told me that when once they got their stock to take to the dry feed they began to improve and deaths ceased.

From the end of March onwards farmers from various places all over the Canterbury Plains asked for advice regarding the unthrifty condition of their hoggets and the varying mortality occurring among them. Our staff Veterinarians in Canterbury visited such places, investigated matters, and gave owners advice according to the circumstances. The Officer in Charge of the Wallaceville Veterinary Laboratory also visited some of the affected flocks and secured specimens for examination. Specimens from affected hoggets were also sent to him by the Veterinarians. The Inspectors of Stock in each of the districts also gave as much assistance as possible in spreading useful information.

Mr. A. M. Paterson, Veterinarian, Timaru, reporting on his experience of the trouble in the South Canterbury districts, remarked as follows :—

The first cases reported concerned hoggets that had been bought in, and which had been bred in the hills. As the season advanced, however, home-bred animals also were found to be affected as badly as the hill-bred ones. In this district the usual procedure is to place hoggets brought from the hills on to grass, then on to grass and rape or grass and turnips, with a run off on to grass and stubble. Occasionally chaff and hay are given, and, very exceptionally, oats. It was in the first stage of this routine that the disease made its appearance—that is to say, when the animals were on new grass with a run off to older pastures. It was also observed that among animals on rape and grass the disease was not nearly so serious, and among those on turnips it was least severe of all. The first symptom noticed by farmers was scouring, but as this was not uncommon among hoggets every winter nothing out of the usual was suspected. Intestinal parasites (worms) were looked upon as the cause of the scouring, and in most cases treatment for these was begun straight away, each farmer using his favourite drench, pill, or powder, according to what experience had taught him to rely upon. All such treatment proved powerless in staying the disease. Coughing was the next symptom noticed, and, lung-worm being suspected, all the old-fashioned remedies for these were tried along with newer drugs, but again without making any impression on the trouble. In spite of all medicaments the affected animals became more languid, more and more emaciated, and many died.

Affected hoggets, at different stages of the disease, were killed and post-mortems made on these, also on hoggets that had succumbed, and, although the results varied according to the stage at which the trouble was taken, all the Veterinarians found practically the same conditions present at similar stages of the disease. Mr. C. S. M. Hopkirk, Officer in Charge of the Wallaceville Laboratory, who in company with Mr. Paterson made post-mortem examinations at the various places where mortalities were occurring in South Canterbury, states as follows in the course of a report :—

An examination of a lamb or hogget following death gave a definite picture early in the season, but was less definite later when the tail of the flock was dying from inanition. Lung-worms were in all cases present, and one of the features of the flock in the latter part of the season was coughing. Pneumonia was not prevalent ; some fluid was found round the heart, and petechiæ on the outside wall of the heart ; the fourth stomach (abomasum) was extremely congested and thickened with œdema. The intestines and cæcum in each case were generally patchily congested ; the contents of the alimentary tract were pasty in appearance, and not the usual dark material seen in sheeps' intestines. Amber-coloured fluid was sometimes present in the peritoneal cavity, and occasionally a little peritonitis was noted. Examination for parasites revealed only a few in the fourth stomach in the majority of cases, many more being found present in the contents of the small intestines where they had passed from the stomach. The round worm (*Ostertagia circumcincta*)—in size about ¼ in. to ½ in. long, and finer than a very fine hair—was the usual stomach-worm found present. A number of whip-worms (*Trichocephalus affinis*) were also found attached to the mucous membrane of the cæcum.

The Veterinarians, who had the opportunity of examining affected hoggets over a considerable period, had no difficulty at certain times in finding large numbers of parasites in the alimentary tract, and also at times in the lungs and bronchial tubes.

When a survey is made of the weather conditions which prevailed during the period when the unthrifty condition and mortality occurred, it will be noted that unusually damp weather occurred during the last three months of 1927. The rainfall probably was not

excessive—in fact, the rainfall for the whole year was below normal —but there were frequent showers and considerably more wet days than usual, and a noted absence of drying north-west winds. The lambs made good progress during the first two months from birth, after which many of them progressed only slowly or did not progress at all and were inclined to be unthrifty. A short spell of better conditions was experienced in the months of January and February, after which the weather was damp and muggy, with an absence of winds, especially nor'westers, right through the harvest and well into winter. So unfavourable was the weather that in many instances farmers had difficulty in harvesting their crops, and the stooks remained in the fields awaiting stacking or threshing until the grain began to sprout. During the late autumn and on into the winter there was an unusual growth of grass of a soft, watery nature, and lambs and hoggets feeding on this in many instances became unthrifty. It was also noted that the winter was mild and that there were few frosty days.

Regarding the cause of the trouble, Mr. Paterson remarked :—

> The general opinion is that the unusual nature of the season was responsible, to a greater or less degree, for the trouble. The autumn was dull, sunless, and windless, mild and showery, and there was an unusual growth of grass. Although farmers formed many opinions about the trouble, it cannot be doubted that it was caused by a lowering of the defences of the body by the innutritious nature of the grass on which the animals were fed during the latter part of March, followed by a serious parasitic infestation of the lungs, stomach, and intestines.

Mr. Hopkirk, in his report, takes a similar view :—

> The warm weather and rainfall in the autumn brought away a tremendous growth of a soft, luscious feed, poorly balanced as regards proportion of solids to water content. The lambs and hoggets were therefore to all intents starved, although on pasture which one might consider good. Starvation increased unless hard food was at once brought into use, or unless the animals were moved on to older pasture or tussock. As the lambs and hoggets declined in health they became a prey for parasites, &c.

It will be evident that the opinion of the officers who investigated the trouble in Canterbury is, briefly, that the unusual weather conditions over the period and the abnormal growth of soft luscious grass during the autumn and winter caused an unthrifty condition among the lambs and hoggets, and that this predisposed them to parasitic affections of the digestive organs and lungs, resulting in a mortality of varying intensity according to the circumstances. This is also my own opinion of the matter. The unthrifty condition of the lambs and the mortality among hoggets were noted to be more prevalent on land which was inclined to be clayey, wet, or of a heavy nature, and the mortality varied in different flocks from a loss of odd hoggets now and again up to over 25 per cent. in special cases.

Mr. Hopkirk, in his laboratory work, by bacteriological tests also found in some specimens at *certain stages* paratyphoid organisms (related to the dysentery group of bacteria which set up dysentery in man) present in large numbers, and he is inclined to the opinion that these organisms accentuated the trouble. He was unable, however, by feeding the organism alone to starved lambs to produce scouring.

TREATMENT AND PREVENTION.

The best results were obtained when the affected animals were changed on to good dry pasture, and assisted with some supplementary dry feed, such as crushed oats in chaff, hay, &c. Also, many of the owners considered that medicinal treatment, such as proprietary tabloids for worms, a mixture of kerol and salt put out in boxes, the 1-per-cent. solution of copper sulphate recommended in suitable doses by officers of the Department, and other medicinal agents, together with the above-mentioned change of food, were a considerable aid in helping to overcome the trouble.

Here a word of warning may be given regarding the drenching of sheep. It should be done with every possible care; if done hurriedly or carelessly the medicinal solution is liable to get into the bronchial tubes and cause pneumonia and bronchitis, resulting in the death of the animal. This actually did occur in several cases, and in one particular instance about 50 per cent. of the mortality was caused in this manner. In other instances good results were obtained when affected animals were put on to sound turnips on dry land, and this supplemented with oaten chaff or crushed oats mixed in chaff. Naturally, the best results were obtained when treatment was commenced early, and before the hoggets were too badly affected and weak for treatment to assist them to recover.

I am of the opinion that if owners of lambs and hoggets, especially in such a season as the one under review, would carefully note any tendency of their stock to become unthrifty, and give them a change on to dry feed, supplementing this with a small quantity of crushed oats in chaff, or even just supply the latter, such troubles as here referred to would be greatly reduced—in fact, would become insignificant. I am also of the opinion that in many instances it would pay to top off the lambs for the meat-freezing works by supplying a small quantity of crushed oats or this mixed in chaff, especially where the lambs are on soil of a clayey or heavy nature, and the grass not that nice short sweet feed suitable for sheep.

It should be clearly understood that the trouble which forms the subject of the foregoing article was not the disease commonly known as pulpy kidney of lambs.

It may also be noted that the unthrifty condition and mortality among the flocks, as referred to, was confined to the plains and foothills of the province. In comparison the back-country (hill) sheep did excellently during the same season.

Cinnabar Moth and Ragwort Control.—A message from Nelson states that the liberation of the cinnabar moth (*Tyria jacobææ*) for the control of ragwort will not be made this spring by the Cawthron Institute as formerly proposed. The reason is that, in reply to inquiries made by Dr. Miller, information has been received showing that the caterpillars of the moth have been known to attack and defoliate potatoes in England and Guernsey. Before a final decision is reached regarding the liberation of the moth further extensive and detailed tests with potatoes and other plants will be first undertaken.

TOBACCO-CULTURE.

SIMPLE INSTRUCTIONS FOR SMALL GROWERS.

C. LOWE, Instructor in Tobacco Culture, Horticulture Division.

THE tobacco-plant is a native of South America, and, like the potato and the tomato, which come from the same region, is susceptible to frost. In New Zealand the plant has been grown successfully in the districts of Nelson, Hawke's Bay, and Auckland for a number of years, but it is only during the past ten years that it has come into prominence as a probable profitable side-line to other horticultural crops.

With proper culture, selection of suitable varieties, and proper curing, it has been established that leaf of good appearance and quality can be produced in this country. At present there is a fair demand for a high-grade quality of leaf, while for the poorer or inferior grades there is little or no demand. Samples of leaf have been sent to London, and the reports received, while encouraging, did not indicate the price which could be expected for leaf shipped in bulk. The London market is already fully supplied, and we can only hope to establish the New Zealand product on that market by exporting a high-grade leaf. In the circumstances intending growers should confine themselves to the culture of a hundred or so plants, so that they may become proficient, without serious loss to themselves, in the proper growing, fertilizing, management, and curing of tobacco. After becoming proficient, and before a larger area of tobacco is planted, due inquiry should be made as to the probable demand for the leaf at a payable price.

VARIETIES.

The question of a suitable variety of tobacco to grow in a particular locality will be governed largely by the soil and climatic conditions. Varieties for the leaf of which there is little or no demand should not be grown. It is advisable that pioneer growers in a district should test several varieties with a view to determining which variety is best suited to the respective localities.

It should be mentioned here that Virginian tobacco is a type of tobacco, not a variety. The varieties of the Virginian type which are recommended are Warne, Hickory Prior, Adcock, Judy's Pryde, and White Stem Oronoko. These varieties yield about the same crop per acre, and they will each kiln-cure.

SOIL, CLIMATE, AND AREA.

Tobacco-plants will grow on a wide range of soils. Soils lacking in organic matter and of poor nitrogenous content are preferable to soils rich in these materials, so that the supply of nitrogen may be controlled. The aim of fertilization in the production of high-grade tobacco is to furnish just sufficient available nitrogen to keep the plant growing vigorously up to "topping" time, but no further, so that the plants will be starved of nitrogen while they are maturing and ripening the leaf. Like other plants, we find that certain varieties thrive better on some soils than do other varieties. In this respect the Warne variety thrives well on soils which are of a light sandy nature and well

drained. Hickory Prior does well on good ordinary arable farming soils. Adcock and Judy's Pryde should be grown on a stiff clay soil to obtain the best results.

The situation selected should be well sheltered from winds. Frequently temporary shelter has to be provided, and this is usually planted after every fifteenth row. Maize provides a quick-growing suitable shelter; it should be planted some weeks before the tobacco is set out.

The optimum annual rainfall for tobacco-growing is from 30 in. to 40 in.

The area to be worked will largely depend on the amount of help that will be available for harvesting operations, shed accommodation, &c. Generally about 2 acres is as much as one man can manage to deal with successfully.

SEEDS AND SOWING.

The seed should be gathered from selected plants which have been properly grown for seed-production. For sowing, only the best warranted seed should be obtained. Poor seed only begets poor plants, which in turn causes loss and disappointment to the grower. The seed is very minute. A long ·22 empty Winchester rifle-cartridge will hold, when filled level with the top, about two thousand seeds. Seed-production should be left to a specialist so that uniformity in type and quality may be maintained. Both of these characteristics are of supreme importance in tobacco stocks.

The preparation of the tobacco seed-bed is similar to that for tomato-seed. The seed should be sown during July in boxes 18 in. by 12 in. by 3 in., in which 2 in. of sterilized well-rotted turf soil has been placed. The boxes should be placed in a glasshouse, where the conditions give quicker germination.

It is advisable, in order that the seed may be sown evenly, to practice sowing seed by using a piece of blotting-paper, 18 in. by 12 in., wet enough for the seed to rest on it. With a little practice one soon becomes proficient at sowing the seed evenly over the surface of the boxes. The seed may be sown out of a rifle-cartridge of the size already mentioned. In a glasshouse the seed will germinate in from ten to fourteen days, while outside it will take twenty-one days. The temperature of the glasshouse during the day should range up to 80° F., and should not fall below 40° at night. In five weeks the plants should be from ¾ in. to 1 in. high. Two thousand seeds should yield fifteen hundred good plants. The number of plants required to plant an acre is five thousand.

PRICKING OUT SEEDLINGS INTO NURSERY BEDS.

It is strongly advised that the plants should be pricked out of the seed-boxes into nursery beds. The pricking-out improves the lateral root-formation, as well as giving the plants richer soil and more room for development. Pricking out ensures a greater number of good plants of a uniform size. By 1st September the seedlings should be from ¾ in. to 1 in. high and ready for pricking out.

For convenience of working it is recommended that the nursery beds should be 12 ft. by 4 ft., with 9 in. timber round the borders of the beds. Extreme care should be exercised in the preparation of the soil for the beds, so as to get rid of any fungus harmful to the plants which may be in the soil. The soil should be sterilized by steam or fire. In the absence of appliances for steaming, gorse-roots or brush-wood should be piled on the soil and burnt. The soil should be reduced to a fine tilth, and passed through a ¼ in. mesh sifter; then 3 lb. of superphosphate and 4 lb. of carbonate of lime should be added and thoroughly mixed with the soil. The beds should be raised to a height of 5 in. or 6 in. above ground-level with prepared soil, and the soil graded over very carefully until the surface is level and smooth. To provide against the danger of late frosts and cold snaps, suitable covers and rollers should be provided to protect the plants against damage. To prevent damage from covers battens are nailed across the frame at suitable distances to keep the calico or scrim off the plants.

A planting-board is necessary to ensure the work being done quickly and neatly. The specifications for a suitable board are as follows: Timber, matai heartwood; lenth, 3 ft. 9 in.; thickness, ¾ in.; width, 4 in. On one side of the board make a 2 in. double bevel. Make some suitable marks at distances of 1½ in. apart on one side of board to mark positions for planting in the soil when the board is inserted into the ground.

With the planting-board open a small trench across the bed, and in it place the seedlings 1½ in. apart, carefully covering the roots. The opening of the next trench, 1½ in. distant, completes the closing of the trench already planted. In about five days the plants should have begun to establish themselves in the soil, and should be showing indications of further growth. From eight to ten days after planting, when the young plants are well established, water the plants with a solution of one egg-cupful of nitrate of soda to a kerosene tin of warm water. The plants usually grow quickly and will smother any weeds. The plants should be ready for planting out in the field by the beginning of November.

PREPARATION OF LAND.

Too little attention is generally given to the preparation of the land for tobacco-culture. The more thorough the cultivation the better the crop is likely to be; poorly prepared land seldom yields good crops. In the late autumn or early winter the land should be ploughed deeply, so as to completely cover all herbage. The burying of all grass and weeds is important, as by this means the food of caterpillars—which are a serious and destructive pest of tobacco-plants—is destroyed. The deep winter ploughing assists in the improvement of the drainage on the stiffer soils, and improves the texture of the soil, and makes it more congenial for the roots of the plant. It also assists in the conservation of moisture during dry spells in the growing-period.

The land should be reploughed in the early spring, but not so deep on this occasion as to bring up the sod turned under at the winter ploughing. The land should be worked regularly—say, every fortnight—after the spring ploughing up till the time of

planting at the beginning of November. It is important, too, that it should be cultivated after rains. Thorough working with disk and harrows is essential for reducing the land to a fine tilth.

Immediately before transplanting is to begin, the land should be levelled and smoothed with a plank drag. It is not advisable to use a roller, for this implement consolidates the ground too much.

MANURES AND FERTILIZERS.

Too rich a soil, and soils which have been too richly manured, cause the tobacco-plants to grow rank and wild. Such plants will produce a dark poor-quality leaf. The presence of readily soluble plant-food applied in the field causes the young plants to start away quickly and to make good vigorous growth while the slower-acting manures are becoming available. In order to obtain suitable growth, it is important that the proper combination of fertilizers be added to the soil.

Immediately after the winter ploughing, lime should be broadcast over the land at the rate of 1 ton per acre the first year and ½ ton each following year. For air-cured tobacco the following fertilizer mixture (per acre) is recommended in the case of new lands known to be poor: 5 cwt. superphosphate (44/46 per cent.), 1 cwt. sulphate of potash. Broadcast one-third of the manure one month after the lime has been applied. Work the fertilizer immediately into the soil. The plants are planted without manure. Ten days after planting apply the balance of the manure as described later. In soils poor in nitrogen it is advisable that the nitrates be added in a mineral form, such as nitrate of soda where quick action is required, or sulphate of ammonia where a slower-acting nitrate is desirable. Care should be exercised to use no more nitrate than is actually required; its use is mainly confined to sands, light sandy loam, and poor clay soils. Where it is intended to kiln-cure the leaf, the amount of sulphate of ammonia applied should not exceed 1½ cwt. per acre.

CONTROL OF PESTS AND DISEASES IN THE CROP.

Four or five days before planting, poison should be laid for cutworms and surface caterpillars. The best time of the day to lay the poison is about 4 p.m. Following is a good poison-bait recipe: Take 1 lb. Paris green, 3 lb. treacle, and 1 bushel bran. Boil the Paris green in 1 gallon water; pour the treacle into the boiling mixture and stir well, then take off fire; add the bran to the treacle and Paris green mixture, and work it up quickly by hand, preventing the mixture from forming lumps. Arsenate of lead, 2 lb., may be used instead of Paris green.

This material should be broadcast at the rate of 1 bushel per acre. One application is usually sufficient. Rain spoils the poison, and when rain falls before the poison has had an opportunity of being effective it should be resown. The poisoned bran should be sown with the assistance of the wind; the bran being thrown in the air, the wind will scatter it more or less evenly over the surface of the ground. The first night probably as many as 75 per cent. of the caterpillars will be poisoned. The cost of poisoning per acre is approximately 8s.

Following is brief information regarding insect pests: Wood-lice are troublesome in seed-boxes; apply flaked naphthalene. Black caterpillars are troublesome at planting; lay poisoned bran prior to planting

as above. Green caterpillars, wireworms, and leaf miners are troublesome later in season; pick off when observed and destroy by burning.

As regards fungus diseases, damping-off is troublesome during the seedling stage, leaf-spot during the growing-period, and mould during the curing-period.

PLANTING.

The rows of plants should run north and south. The rows are set 4 ft. apart, so as to allow of sufficient room for working the soil and harvesting operations. The plants are set 2 ft. apart in the rows. On this basis five thousand plants are planted to the acre. Any variation in these distances should only be made after the first season's experience of what the land will do.

The position for the first line of plants is marked out by a line of rods, which are 4 ft. long. Open a little furrow with the Planet Jr. (No. 17) implement, 3½ in. deep along the line of the markers. As the markers are reached they should be removed and placed in position for the next line, 4 ft. away from the first line. Each stake, being 4 ft. long, acts as a measuring-rod.

The plants should be lifted from the beds with plenty of soil attached to the roots, and placed in suitable carrying-tins. The planters follow the Planet Jr. implement. Soil which was thrown out in making the furrow is now carefully drawn back by hand on to the plants after placing them firmly in position; the return trip of the plough fills the furrow. The plants should be planted deeply in the manner described, so that the terminal bud is slightly below the level of the soil when planting operations are completed. This protects the plants from late frosts and drying winds, and gives them an opportunity of establishing themselves. No manure is applied at planting-time.

REPLACEMENT OF LOSSES.

In order to provide plants for replacing losses, it is the custom when planting to place the plants in every eighth row 1 ft. apart. By this means plants of age, development, and vitality and maturity of leaf equal to those in the field can be used for replacement of losses. It is important that the development and maturity of the plants throughout the field should be kept as even as possible. It is better to have gaps than a field of plants which are uneven in development and maturity. The filling-up of gaps should not extend beyond ten to fourteen days after planting. To replace, dig a suitable hole with a shovel or spade, then go to a nearby row having the extra plants, take up a good shovelful of soil with the plant, and carefully transfer it into the prepared hole without disturbing the roots. Alternate plants in the filler row should be left. Firm the soil about the plant, which should continue its growth as though it had been undisturbed. When the replacing has been completed, any unused plants intended for fillers should be cut off at the ground level. The fillers not required should not be left longer than one month after planting.

SUMMER TREATMENT.

Ten to fourteen days after planting the plants should be moulded up in a manner similar to that followed with potatoes.

The remaining two-thirds of the fertilizer recommended should now be applied to the soil along the furrows which have been created by the moulding. Cover the fertilizer immediately after sowing. A suitable method of distributing the fertilizer is to carry it in a bucket, and use a lid of a 2 oz.-tobacco-tin to distribute the manure. The rate of sowing is approximately a lidful to each plant.

After planting, the grower should continue to carefully work the land once a week and after rains. These cultivations should not be neglected, as they are an important factor in the production of good leaf. A suitable implement is the Planet Jr. (No. 17) wheel-hoe with three curved teeth.

The plants will run up quickly to their full stature. It will not be found practicable to work the soil much after Christmas-time without damaging the leaf. With a view to ripening off the leaf it is advisable that cultivation should cease after the plants have reached full height.

TOPPING, PRIMING, AND SUCKERING.

An average plant will have from ground to seed-buds twenty-two leaves. The practice is to top normal plants just above the twelfth leaf. In commencing tobacco-culture ten leaves is a good standard to work on, varying the practice according to the development of plant and leaves. If the plants are strong-growing and the leaves inclined to be coarse, increase the number of leaves on the following year's plants to twelve; if, on the other hand, the plants are weakly and the leaves of a papery texture, only eight leaves should be retained.

When growing for air-curing, the plants require to be topped when the first flower-buds are showing "pink." This will be about or shortly after Christmas, according to locality. The leaves (about three) at the bottom of the plant should be knocked off with the hands, so that the remaining leaves may be kept clear of the soil, and to permit of a free air movement in and around the plants. The three or four leaves at bottom — known as "lugs" — ripen earlier, are smaller, frequently damaged on the soil, and only about a quarter of the value of those higher up on the plant. The foliage requires as much sunlight as possible, and as the lower leaves are usually much shaded it is advisable that they should be removed to ensure an evenness of maturity in the crop of leaves to be harvested.

Count the leaves and top off. The leaves left on the plant should be fairly even in size. The tops and lower leaves removed should not be left underneath the plants, but put in the middle of the 4 ft.-wide rows, where they will soon dry up and go back to the soil.

If the crop is being grown for kiln-curing no priming is done. When the first flower-buds are showing pink, top back to point where the leaves are the size of laurel-leaves.

Lateral growths usually develop about ten days after topping. They should be removed when about 3 in. long. Disbudding will require attention about every ten days until the leaf is gathered.

The crop should be ripe from thirty to forty days after topping, according to the weather conditions—normally in the early part of February.

HARVESTING AND CURING THE LEAF.

For a shed-cured crop the grower should be guided by the four middle leave of the plants. They should be taking on a mottled appearance—the mottlings being about the size of a threepenny-piece. The texture of the leaves should be thick and dense in feeling; they should be crisp and break when bent. The bottom leaves will be fully ripe. For kiln-curing the leaves should be gathered when they appear to be ripe. It is estimated that a normal crop will produce 800 lb. of dried leaf per acre.

The tobacco is cured in partially open sheds or in kilns. Shed-curing is a slow method. In the case of people of small means the extra expense of building a suitable kiln would put kiln-curing out of the question. The cost of building a suitable kiln capable of dealing with 4 acres of tobacco would be about £100 to £112. One curing would take about three sacks of coke and two barrowfuls of wood. The labour wages for filling the barn and curing the leaf, where outside help was required to do this work, would be about £8 for each kilnful. The measurements of the kiln are 16 ft. by 16 ft., with sides 20 ft. high to the eaves. This is sufficient to hold five tiers of whole plants. A furnace is also required as a means of providing the necessary heat for the kiln.

Sheds or barns require to be well ventilated. Two ends should be open, so that winds may pass through the shed and down the rows of tobacco sticks and plants. Sacking or heavy scrim protections should be available for immediate use on the open ends, should occasion arise for these to be covered to protect the leaf hanging in the shed. The tobacco-sticks should run lengthwise so that the wind may pass down between the sticks. When the sticks are stored with green leaf they should be arranged 1 ft. apart. Later, when the leaves have dried to some extent, the distance between the sticks may be reduced to 8 in.

For shed drying the plants are cut off at or near the ground-line; when the dew has dried off them. The plants are tied in pairs. The green leaves should be handled with extreme care, as they are very easily broken or damaged, with consequent considerable loss in value; bruised leaves will not cure. The sticks are usually 4 ft. 3 in. long; eight pairs of plants are hung on a stick. The plants require to be placed in the drying-sheds out of the sun without any undue delay.

The leaf at first turns a yellow colour, and then brown, as chemical and bacterial changes take place in it. The leaves should remain on the stalks until the midrib of the leaves is brown. Screw the ribs with the fingers to ascertain whether the moisture has evaporated sufficiently to permit of the stalks of the leaves being tied together for a considerable time without decay developing.

Another system of harvesting is to split the stem with a sharp knife to within 4 in. of the ground when the leaves appear to be ripe; select a warm sunny day for the work. The tobacco should be allowed to remain in the field for three days to dry out the stems. At the end of this time, if the stems are sufficiently dry, they should be cut off at

the ground-line. The plants should not be left lying in the sun, but hung over the curing-sticks and carried into the barn.

In neither case should the leaves be handled while they are very dry and brittle, otherwise they will break up and be a total loss. In a humid atmosphere the dry leaves reabsorb moisture, and when sufficiently pliable they may be handled carefully without damage. The leaves when ready are removed from the stalks, graded, and tied in "hands" of twenty leaves. The leaves may be rehung again in the barn, and must be kept dry and reasonably warm so as to avoid the development of mould.

The warning indication of mould is a sour, dank smell. It develops and spreads quickly on the leaves when conditions are suitable. Immediately it is observed a hole should be dug in the floor, a good log (one which will burn slowly for three days) laid in the hole and set on fire. When the fire has got a good hold cover the burning log carefully with dry ashes. The result should be that a small quantity of blue smoke is disseminated through the shed.

The method of harvesting for kiln curing is for the leaf to be gathered as it is ready, beginning at the bottom of the plants and working up. Some of the lower leaves, through damage and dirt, may be of no use except for making tobacco-spray for insecticidal purposes. The picker picks in two rows of plants and takes off the lower leaves first; the remainder are taken as they ripen. The leaves taken at each picking should be as even as possible in respect to colour and maturity. The picker carefully places the leaves on a stretcher made from two wooden bars to which have been nailed fruit-case lids. When fully laden the stretchers are carried to a point, preferably in the shade, where the leaf is graded and put on a curing-stick 4 ft. 3 in. long and standing on a trestle. The laden sticks are taken to the kilns and placed in position for the curing process. When placed in the barn the bottom tier should be at least 7 ft. from the ground. The tips of the leaves above should be distant from 3 in. to 4 in. from the stems of the leaves on the tier below.

Kiln curing should be carried out in conformity with the flue-barn chart issued by the Horticulture Division, Wellington. Plans for useful sheds for air-curing, built with bush poles, thatched roof, and manuka sides, can also be obtained from the Division. After curing the leaf is stored in a dry warm building, when it is carrying 12 per cent. of moisture.

The shed-cured tobacco-leaves must be stripped carefully from the stalks when they have been cured and have become sufficiently pliable to handle. They should be graded according to the specified grades, and tied up in hands of from fifteen to twenty leaves, according to the thickness of the midribs. For bulking down the moisture should be right—neither too dry nor too wet; 12 per cent. of moisture is considered to be the correct thing. To some extent this is indicated by the feel of the leaf, which should be similar to that of an old leather glove. When the leaf is crushed in the hand and released the creases should come out almost at once. The leaves are laid in bulk to a height of 3 ft. A board or other suitable material is laid on top and weighted down with stones of moderate weight. The bulk leaf should be protected from drying or moistening influences.

Finally, the cured leaf should be carefully packed in bales or other suitable containers for transport to the receiving-store.

IMPERIAL AGRICULTURAL RESEARCH CONFERENCE, 1927.

OFFICIAL REPORT OF THE NEW ZEALAND DELEGATES.

THE following report concerning the Imperial Agricultural Research Conference held in London last year, by Dr. C. J. Reakes and Mr. T. Rigg, the New Zealand delegates, is attached to the annual report of the Department of Agriculture for 1927–28, presented to Parliament this month :—

Recognizing the profound influence which agriculture is destined to exert in the future in the promotion of the prosperity of the Empire and the happiness of its people, the Governments of Great Britain and of the Dominions have tried earnestly since the conclusion of the war to improve the status of agriculture in their respective countries. The importance of surveying the problems of agriculture throughout the Empire, of co-ordinating research work, of effecting a better utilization of the results of research, and of training efficient workers was recommended by the Imperial Conference of 1926 for the sympathetic consideration of the respective Governments of the Empire.

It was therefore not surprising that with the advent of the Empire Marketing Board and the stimulus given to agricultural research by its efforts the invitation of the British Ministry of Agriculture to the Dominions, Crown colonies, and dependencies, to send delegates to an Imperial Agricultural Conference in England met with ready acceptance from all parts of the Empire.

No effort was spared by the Ministry of Agriculture or the Empire Marketing Board, which defrayed the cost of all secretarial work and of the entertainment of delegates in England, to make the Conference in the highest degree successful. The Governments of the Dominions and the Colonial Office contributed in no small measure to the success by sending their representatives to attend the Conference and take part in its proceedings. The Conference was supported whole-heartedly by the agricultural-research stations of Great Britain, and every facility was granted overseas delegates to inspect the work which was being carried out and to discuss with the scientific staffs at these stations problems of mutual interest.

Too much stress cannot be laid on the value to agriculture which accrued from the opportunities thus afforded delegates of meeting one another and of discussing their work. In many cases it was realized, in some cases for the first time, that workers in other parts of the Empire were investigating similar or allied problems. Frequently a new approach to a particular problem resulted from the discussions which took place.

WORK OF THE CONFERENCE.

Early in the proceedings of the Conference it was clearly recognized that matters of broad policy affecting the development of agriculture in every part of the Empire deserved special consideration by the Conference as a whole. Such questions as follow were all matters of great importance to every part of the Empire, and were considered in detail by the Conference :—

(1) The establishment of Imperial bureaux and information centres for various branches of agricultural science.

(2) The collection and dissemination of information on agricultural problems throughout the Empire.

(3) The desirability of creating special research stations for the investigation of particular problems.

(4) The recruitment and training of agricultural workers.

(5) The establishment of permanent machinery which could conduct the secretarial work of the Conference and of other conferences which might be arranged in the future.

Specialist Commissions of technical and research officers met during the course of the Conference to consider the needs of agricultural research in different branches of agricultural science. Many valuable recommendations were submitted by these Commissions to the Conference.

Among the important matters which were considered in detail by the Administrative Commissions of the Conference, those relating to (1) the dissemination of information, and (2) the creation of Imperial bureaux and information centres were of great importance to all the Dominions.

In the past, agricultural officers in the Dominions have been dependent to a very large extent on the fundamental knowledge which has been gained by many famous research stations in Great Britain and Europe, often by prolonged and deep research, and Dominion workers have effected a practical solution of many problems confronting the agriculture of their countries by the application of such fundamental knowledge to their own particular conditions. While it is highly desirable that the value of fundamental research should receive the fullest recognition, direct attacks upon the great economic problems of agriculture in the Dominions must remain for many years the prime consideration of our workers. In the solution of such Dominion problems specific fundamental research will frequently be required, but the efficient application of existing knowledge must constitute the first line of attack.

In many cases it will be found that Dominion workers who are in touch with the progress of fundamental research in Great Britain and other countries will be able to suggest a practical solution of the problem confronting them. Full success in the solution of economic problems, however, is not likely to be obtained unless well-trained officers are available who keep abreast of the development of research work in other countries.

CO-OPERATION IN AGRICULTURAL RESEARCH.

One of the most valuable results of the Conference should be the co-ordination of agricultural research throughout the Empire. This should eliminate unnecessary duplication of effort, and should release both personnel and money for direct attacks on many economic problems which await solution.

The proposed Imperial bureaux and information centres should play an important part in economizing effort and in co-ordinating agricultural research. It was definitely recommended by the Conference that the bureaux and information centres should collect data and information in specific branches of agricultural science not only from all parts of the Empire but also from other sources throughout the world. One of the important functions of the bureaux and information centres will be the dissemination of this knowledge to individual workers in different parts of the Empire. In order that the greatest benefit may be secured from the work of the more famous research stations in Great Britain, it was recommended that the bureaux and information centres should be attached to particular research stations. This should ensure reliability in the information disseminated and help to bring about personal contact between overseas investigators and officers conducting research in Great Britain.

It will be possible for the bureaux to establish contact between workers in different parts of the Empire who are investigating similar problems. By this means they will be enabled to compare notes and interim results. In such cases one might expect the development of new lines of approach to a problem greatly hastening thereby its solution.

Where problems of general importance to several parts of the Empire are encountered arrangements will, no doubt, be made through the bureaux and information centres for a concentration of effort by some particular research station on such problems. Workers in other parts of the Empire would then be able to co-operate by the prosecution of research on some aspect of the problem which was of particular importance to their own country.

Co-ordination of research in the Empire cannot be attained without the support of scientific workers. The opportunities afforded by the Conference for discussions between workers from many parts of the Empire were of great value in establishing a real understanding between workers engaged on similar activities. The personal contacts made by Dominion workers should prove invaluable in the prosecution of their work. It will render possible much greater freedom of inquiry and of discussion.

The Conference unanimously endorsed the suggestion of periodical conferences for agricultural workers. In certain parts of the Empire regional conferences of specialist officers should prove of the utmost value.

Delegates were impressed with the importance of securing study-leave for isolated workers, and of facilitating an interchange of visits between workers in different parts of the Empire.

The recommendations of the Conference envisage the establishment of Imperial bureaux in the following branches of agricultural research :—

(*a*) Soil science. (Bureau to be attached to the Rothamsted Experimental Station.)

(*b*) Animal nutrition. (Bureau to be attached to the Rowett Institute.)

(*c*) Animal health. (Bureau to be established in London.)

In addition to these bureaux, the establishment of clearing-stations for information were recommended in the following subjects :—

(*a*) Animal genetics. (Station to be attached to Animal-breeding Research Department, Edinburgh University.)

(*b*) Agricultural parasitology. (Station to be attached to the Institute of Agricultural Parasitology, London.)

(*c*) Plant genetics. (One station to be attached to the Plant-breeding Institute, Cambridge University, to deal with all crops of temperate and tropical regions except herbage plants.)

(*d*) Another station to be attached to the Welsh Plant-breeding Station at Aberystwyth to deal with herbage plants.

(*e*) Fruit-production. (Station to be attached to the East Malling Research Station, Kent.)

The subjects to which the proposed bureaux and correspondence centres have reference are equally important in their bearing on agriculture to all parts of the Empire. It is a matter of congratulation that in almost every case the bureaux and information centres will be attached to research stations where much active work on the particular subject to which the bureaux and centres have reference is being pursued.

The suggestion that facilities should be made available through these Imperial bureaux for the training of selected Dominion workers met with the hearty approval of the Conference, and will extend still further the valuable work which the proposed bureaux and information centres will undertake for the development of agriculture in the Empire.

WORK OF THE TECHNICAL COMMITTEES.

Much valuable work was done by the technical committees which were established to consider the needs of research in different branches of agricultural science. Recommendations were made by these committees on the necessity or otherwise of creating clearing-houses for information in different subjects, on the functions of bureaux, and their organization to serve the special needs of different branches of science. Joint programmes of research between different parts of the Empire were considered, and the use of standard methods for experimental work was earnestly recommended.

Special problems requiring urgent consideration were brought to the notice of the Conference so that definite action could be taken by the responsible authorities.

PASTURE TOP-DRESSING EXPERIMENTS IN SOUTH OTAGO.

RESULTS OF TWO-YEAR PLOTS, SEASONS 1926–27 AND 1927–28.

R. B. TENNENT, N.D.D., Fields Superintendent, Dunedin.

DURING the season of 1926–27 three pasture top-dressing experimental plots were laid down in South Otago. These were designed to test the efficacy of superphosphate, basic slag alone, and slag in conjunction with lime; the effect of lime alone on grassland was also included in the scheme. The pastures selected were situated on soils representative of a large area of country, and it was anticipated that from the accurate design of the experiments, valuable information would be obtained.

Details of these plots were given in the *Journal* for May, 1927, and it is not necessary here to recapitulate particulars of their lay-out. It will suffice to say that in the case of the two plots at Crookston superphosphate (44–46 per cent. grade) and basic slag were applied at 2 cwt., and ground carbonate of lime at the rate of 1 ton, per acre. In the case of the Awamangu plot superphosphate (44–46 per cent.) was applied at $3\frac{3}{4}$ cwt., basic slag at $5\frac{1}{2}$ cwt., and carbonate of lime at 1 ton, per acre.

The main object of the experiments was to determine the immediate effect of the various fertilizers in promoting the growth of grass and clover, and with a view to ascertaining the length of time over which the initial dressings would prove effective it was decided to keep the plots under observation for a period of at least four years. As a gauge for determining the effect of the various treatments the plots were closed to stock for a period of time sufficient to allow a hay crop to be taken, which would thus afford comparisons to be made. It is, of course, realized that this means of estimating the effect of the various fertilizers is at best not fully indicative; nevertheless, in conjunction with visual observations of the changes effected in the pasture constituents, it affords reasonable idea of just what reactions are taking place as a result of the different treatments.

The following tables give full particulars of the 1927–28 season's results, and also show the combined results for the two seasons under review.

Table 1.—D. Smollett, Awamangu : 1927–28 Season's Results.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Result: Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.
		lb.		T. Cwt. Qr.
24	Basic slag	80·6	S	3 10 3
36	Basic slag and lime ..	82·6	S	3 12 1
24	Superphosphate ..	69·0	S	3 0 1
36	Super and lime ..	71·3	S	3 2 1
24	Lime	76·6	S	3 6 3
..	Control (no manure) ..	64·3	..	2 16 0

Table 2.—D. Smollett, Awamangu : Two Seasons' Results.

Manure.	Season 1926–27: Estimated Weight of Hay per Acre.			Season 1927–28: Estimated Weight of Hay per Acre.			Total value of Hay at £5 per Ton.			Cost of Manure.			Profit or Loss compared with Unmanured Plot.			
	T.	Cwt.	Qr.	T.	Cwt.	Qr.	£	s.	d.	£	s.	d.		£	s.	d.
Basic slag ..	2	11	1	3	10	3	30	10	0	1	13	0	Gain	6	7	0
Basic slag and lime	2	12	1	3	12	1	31	2	6	2	7	0	Gain	5	15	6
Superphosphate	1	15	0	3	0	1	23	16	3	1	2	6	Gain	0	3	9
Super and lime	1	16	2	3	2	1	24	13	9	1	16	6	Gain	0	7	3
Lime ..	1	16	0	3	6	3	25	13	9	0	14	0	Gain	2	9	9
Control ..	1	14	0	2	16	0	22	10	0	..			..			

Table 3.—I. D. Revie, Crookston : 1927–28 Season's Results.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Result: Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.
		lb.		T. Cwt. Qr.
30	Basic slag	26·3	S	1 5 2
30	Basic slag and lime ..	23·3	N	1 0 1
30	Superphosphate ..	34·4	S	1 10 0
30	Super and lime ..	32·7	S	1 8 2
32	Lime	21·6	N	0 19 1
..	Control	21·3	..	0 18 2

Table 4.—I. D. Revie, Crookston : Two Seasons' Results.

Manure.	Season 1926–27: Estimated Weight of Hay per Acre.			Season 1927–28: Estimated Weight of Hay per Acre.			Total Value of Hay at £5 per Ton.			Cost of Manure.			Profit or Loss compared with Unmanured Plot.			
	T.	Cwt.	Qr.	T.	Cwt.	Qr.	£	s.	d.	£	s.	d.		£	s.	d.
Basic slag ..	1	10	3	1	5	2	14	1	3	0	15	7½	Gain	1	10	7
Basic slag and lime	1	8	1	1	0	1	12	2	6	1	9	7½	Loss	1	2	1
Superphosphate	1	16	1	1	10	0	16	11	3	0	15	3¾	Gain	4	1	0
Super and lime	1	16	0	1	8	2	16	2	6	1	9	3¾	Gain	2	18	3
Lime ..	1	7	3	0	19	1	11	15	0	0	14	0	Loss	0	14	0
Control ..	1	8	2	0	18	2	11	15	0	..			..			

Table 5.—W. H. Lusk, Crookston : 1927–28 Season's Results.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Result: Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.
		lb.		T. Cwt. Qr.
24	Basic slag	48·3	S	2 2 1
24	Basic slag and lime ..	42·0	N	1 16 3
24	Superphosphate ..	52·9	S	2 6 1
24	Super and lime ..	46·1	S	2 0 1
30	Lime	41·3	N	1 16 0
..	Control	41·2	..	1 16 0

Table 6.—W. H. Lusk, Crookston : Two Seasons' Results.

Manure.	Season 1926–27: Estimated Weight of Hay per Acre.			Season 1927–28: Estimated Weight of Hay per Acre.			Total Value of Hay at £5 per Ton.			Cost of Manure.			Profit or Loss compared with Unmanured Plot.			
	T.	Cwt.	Qr.	T.	Cwt.	Qr.	£	s.	d.	£	s.	d.		£	s.	d.
Basic slag ..	1	2	3	2	2	1	16	5	0	0	15	7½	Gain	0	15	8
Basic slag and lime	1	1	2	1	16	3	14	11	3	1	9	7½	Loss	1	12	1
Superphosphate	1	6	2	2	6	1	18	3	9	0	15	3¾	Gain	2	14	9
Super and lime	1	6	1	2	0	1	16	12	6	1	9	3¾	Gain	0	9	6
Lime ..	1	1	3	1	16	0	14	8	9	0	14	0	Loss	0	15	0
Control ..	1	2	3	1	16	0	14	13	9	..			..			

As will be seen from the tables, the effect of various phosphate dressings has been to provide an increased growth of grass over the unmanured strips. It seems remarkable that even after two years' application there has been no effect from the application of carbonate of lime on the two Crookston plots. These soils showed a definite "lime-requirement," yet so far as visual observation is concerned no appreciable difference in growth can be noted. At the conclusion of these experiments it is hoped to make a point analysis of each pasture, so as to determine the varying percentage of pasture constituents on each series of treatments. An endeavour has been made above to fix a monetary value to each treatment, but in so doing it is to be borne in mind that although the hay taken off the plots has been valued at the high figure of £5 per ton, that hay merely represents the produce derived from the plot over the comparatively short time of from ten to twelve weeks. A full appreciation of the effect of the original dressings cannot be obtained until the completion of this experiment. This brief account should be regarded merely as a progress report.

The writer's thanks are due for the facilities and assistance given by the farmers concerned in the experiments, and acknowledgment is made to Messrs. A. S. Duff and A. A. Hume, of the Fields Division Staff, for their help in recording the results.

HOT-WATER TREATMENT OF SEED BARLEY.

FIELD EXPERIMENTS IN CANTERBURY, SEASON 1927–28.

C. H. HEWLETT, Canterbury (N.Z.) Seed Co., Ltd., Christchurch.

THE following matter presents the practical results of the hot-water treatment of seed barley in the Ellesmere district of Canterbury for the season 1927–28. Results for the previous two seasons were published in the issue of this *Journal* for June, 1927.

The method of treatment employed was in essentials that of the previous season—a presoak of five to six hours in water at 60° to 70° F., followed by a dip of five minutes in water held at 127° F. Improvements in technique suggested by the previous season's experience resulted in this season's seed showing very little reduction in vigour of germination following treatment. The seed direct from treatment was sown on the Canterbury Seed Company's farms at Leeston and Lake Road, and was also supplied to a number of farmers growing barley on contract for the company in the Ellesmere district.

The following tables present a condensed summary of the actual harvest results from both treated and untreated seed.

Table 1.—Yield of Seed "Direct from Treatment" and of Untreated Seed.

Variety.	Treated.			Untreated.			Increased Yield over Untreated.	Total Acres.
	Number of Farms.	Acres.	Yield per Acre.	Number of Farms.	Acres.	Yield per Acre.		
			Bushels.			Bushels.	Per Cent.	
Archer Spratt ..	9	134	79·6	58	1,059	64·7	23·02	1,193
Chevallier ..	7	136	67·4	15	212	55·2	22·10	348
							Decrease	
Plumage	2	49	45·5	13	169	60·9	25·29	218
Plumage Archer ..	2	40	71·5	..	..	..	..	40
Goldthorpe Spratt	2	40	61·4	..	..	..	..	40
	22	399	..	86	1,440	..	..	1,839

NOTES.—All treated seed was absolutely free from smut. One lot of direct-treated Plumage was drowned out, and the other one was sown too late. Yield figures are for firsts only.

The product shown in Table 1 was graded as follows:—

Table 2.—Grading of Product.

Quality.	Archer Spratt.		Chevallier.		Plumage.		Plumage Archer.	Goldthorpe Spratt.
	Treated.	Untreated.	Treated.	Untreated.	Treated.	Untreated.	Treated.	Treated.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
First grade ..	91·71	75·46	97·0	53·84	14·7	93·44	100·0	100·0
Second grade ..	8·29	19·10	3·0	40·01	85·3	6·02	..	..
Under grade ..	..	5·44	..	6·15	..	0·54	..	..
Total ..	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0

The difference in value per acre between the treated and untreated Archer Spratt and Chevallier barleys is as follows: Archer Spratt—Increased value of treated over untreated, £3 12s. 8d.; Chevallier—Increased value of treated over untreated, £2 9s. 9d.

It will be noticed that although the treated Chevallier and Archer Spratt gave an increase both in yield and quality compared with the untreated, the treated Plumage did not do as well as the untreated. The reason was that of the two lots of treated Plumage one lot was drowned out and should have been ploughed up and resown, and the other lot was sown too late. This in itself is a valuable lesson, showing that in agriculture, as in other industries, even with the very best of materials, skill and care are necessary to produce good results.

The crops, product of the treated seed, were inspected early in January, 1928, and again later by Mr. J. C. Neill, Field Mycologist, Department of Agriculture, and were found to be absolutely free from smut.

The results attained during the past season confirm the experiments of the two previous years. Over 400 acres of various varieties of directly treated seed were grown; the drills used were cleaned out and disinfected with a strong solution of formalin; the reapers and binders were treated in the same manner before reaping operations commenced; and the threshing-machines were also similarly treated before threshing. This was done with a view to prevent reinfection of the product, so as to enable sufficient seed to be saved this year to provide enough "once removed" seed to sow the whole of the Canterbury barley crops for the 1928–29 season, and thus eliminate the smuts from the bulk of the malting-barley crops of Canterbury. For this purpose both the Canterbury (N.Z.) Seed Co., Ltd., and New Zealand Breweries, Ltd., have arranged to use for seed purposes in their contracts only the seed "once removed from treatment," produced from the crops mentioned in Table 1.

The whole programme of experiments was carried out with the valued advice and assistance of Mr. J. C. Neill. Thanks are due to other members of the Agriculture Department for their assistance in various ways, also to Mr. H. Neave, the Seed Company's manager at Leeston, who superintended the sowing and harvesting operations.

Experiments have also been carried out on somewhat similar lines with about 1,000 acres of wheat and oats. This work is being continued, but is not yet far enough advanced for publication of results. Experiments will be continued during the coming season with barley, wheat, and oats.

"*Finest*" *Grade of Butter and Cheese.*—The Director of the Dairy Division touches on this matter in his annual report for 1927–28 as follows: "The use of 'finest' grade, which includes all creamery butter and factory cheese scoring 93 points and over, has been in operation throughout the year. Despite the difficulties experienced by butter and cheese makers in consistently manulacturing a highest-quality article, chiefly through the extremely dry weather conditions which prevailed, 68·33 per cent. of the butter and 34·15 per cent. of the cheese graded was classed in this highest grade. Evidence appears to be accumulating to the effect that 'finest' quality is worthy of a premium in price over 'first' grade."

CITRUS-CULTURE.

VARIETY AND ROOTSTOCK EXPERIMENTS AT TAURANGA, SEASONS 1926–27 AND 1927–28.

P. EVERETT, Orchard Instructor, Thames.

DEFINITE progress has been made in the establishment of commercial citrus plantations in New Zealand of late years. Many different varieties of lemons, oranges, limes, mandarins, and grape-fruits have been tested, not only by the Department of Agriculture but also by individual growers, and the knowledge so gained has been of considerable help to growers. The importance of selecting suitable rootstocks has also been amply demonstrated at Tauranga.

When the Department's Tauranga Horticultural Station was disposed of in 1923 the Manager, Mr. J. H. Davidson, undertook to carry on the citrus tests—both variety and rootstock—then under way. A progress report on these tests was made by him in 1926, and published in the April issue of this *Journal* that year, illustrated with a number of photographs. The present report deals with the subsequent development and existing condition of the trees under test, together with particulars of yields for the seasons 1926–27 and 1927–28, each season being reckoned from April to the following March. The crop records were kindly supplied by Mr. Davidson.

When considering the crop records (as given in the report on rootstocks) it should be borne in mind that throughout the Tauranga district there have been light crops of almost all citrus-fruits for the past three years. The 1927–28 season's crop was one of the lightest ever experienced in the Bay of Plenty, being in most cases almost a complete failure. The crop that is being harvested at the time of writing (July, 1928) is a heavy one, and it can safely be said that when the yield figures for the present season's crop are available a very large increase will be recorded.

Lemon Variety Tests.

Eureka.—This variety has made very strong growth, and is a more consistent cropper all the year round than most other varieties. The fruit is mostly a good even shape and large. The style of tree-growth is inclined to be straggly, and the fruit is largely borne near the tips of the branches. This weakness of the Eureka can be remedied, to a certain extent, by periodically shortening back the strong-growing young growth. The variety is a suitable one to plant for commercial purposes. The tree is thornless.

Lisbon.—In the 1926 report referred to, it was stated that this block of trees was then the poorest in the area, and that the rootstock were old and stunted when the trees were received from the nursery. In spite of these facts the trees are now making great growth annually, and are as large as trees of any other variety of the same age. For the two years under review they have averaged the heaviest crop. The fruit is mostly of good size and even shape. The trees are nicely compact and bushy. Buds on the lateral growth are closer together,

and more fruit is produced in the interior of the tree than is the case with Eureka. The Lisbon is a thorny variety, but the thorns are not sufficiently numerous to be a serious deterrent to the planting of this variety.

Villa Franca.—This is proving to be a fair commercial variety for Tauranga conditions. The trees are not so large as either Eureka or Lisbon, although the growth made is reasonably satisfactory. The variety has a good, stocky style of growth, and the buds on the lateral branches are close. The fruit is now mostly a good size and shape. It is a heavy summer bearer, which is decidedly in its favour. For the first four years of cropping the fruit was inclined to be spherical in shape, as the nipple did not grow out. During the last two years this undesirable characteristic has almost completely disappeared, except with the trees on Rangpur lime stocks, and with these the weakness is still very evident. The principal drawback to Villa Franca is the roughness of the fruit from young trees, and the fact that it is not quite such a vigorous grower as Lisbon or Eureka.

Messina.—The growth of the trees of this variety is in many ways similar to that of the Lisbon, but not so vigorous. The general habit of the tree is to form rigid upright growth, with the fruit and foliage mostly on the tips of branches. There are very few lateral fruiting-twigs and many bare branches. A considerable proportion of the fruit is inclined to be unduly elongated, which considerably reduces its commercial value. The tree is very thorny.

Genoa.—This variety has the drooping style of growth that is characteristic of Eureka, but with finer foliage and growth. It is not such a vigorous grower as Eureka, Lisbon, or Villa Franca. This is probably due largely to the heavy-cropping habit of the trees when very young. The fruit is the most attractive in appearance of any variety grown in the locality, being practically perfect in shape and very smooth. Some of the winter-crop fruit does not quite attain the most suitable size for commercial purposes. If this variety of tree could be made to grow as vigorously as the Eureka or Lisbon for about the first six years from planting, it would probably prove the most profitable variety to grow. This could possibly be done by preventing the trees from maturing heavy crops of fruit while very young.

Persian (Sweet) and Rangpur (Acid) Limes.—Both of these varieties of limes are vigorous growers and heavy croppers, but the fruit is small. There is practically no demand for this class of fruit, and such limes therefore cannot be recommended for commercial planting.

Lemon Rootstock Tests.

The crops indicated in the following notes are the average of all trees on the particular kind of stock; 150 lemons have been reckoned as one case. The age of the Messina trees is nine years and all other varieties ten years, reckoned from planting.

(1) Eureka on sweet orange: Trees are making good typical growth of the variety, and cropping well. Crop, 1926–27, 4 cases; 1927–28, 2·01 cases, per tree.

(2) Eureka on rough lemon: Trees and fruit similar in every way to No. 1, except that the trees are slightly larger and the crop a little heavier. Crop, 1926–27, 4·05 cases; 1927–28, 2·05 cases, per tree.

(3) Eureka on *Citrus trifoliata:* Trees extremely dwarfed and useless. Crop, 1926–27, 0·06 case; 1927–28, 0·03 case, per tree.

(4) Eureka on Rangpur lime: The growth of these trees is not equal to No. 1 or No. 2. A number of trees on this stock have been blown over at different times, due to the shallow-rooting habit of the Rangpur lime. The quality of the Eureka fruit is better on this stock than on any of the other stocks under test. Crop, 1926–27, 2·05 cases; 1927–28, 1·05 cases, per tree.

(5) Eureka on "ordinary" lemon: Considerably smaller tree than No. 1 and No. 2, but quality of fruit similar. Crop, 1926–27, 3 cases; 1927–28, 1·06 cases, per tree.

(6) Lisbon on sweet orange: All trees have made very great growth, and are bearing heavy crops of good average-quality fruit. Crop, 1926–27, 5 cases; 1927–28, 2·05 cases, per tree.

(7) Lisbon on rough lemon: The growth of these trees is almost equal to that of No. 6, but the crop is lighter and the fruit noticeably smaller. Crop, 1926–27, 2·05 cases; 1927–28, 1·05 cases, per tree.

(8) Lisbon on *Citrus trifoliata:* Poor tree-growth has been made as compared with No. 6 and No. 7, yet these trees are quite three times the size of the Eureka variety on the same stock. Heavy crops are being produced for the size of the trees. Crop, 1926–27, 2·01 cases; 1927–28, 1·05 cases, per tree.

(9) Lisbon on Rangpur lime: These trees have made slightly better growth than No. 6, and are the most vigorous-growing lemons in the whole of the test area. The fruit is equal in quality and similar in amount to No. 6. Crop, 1926–27, 4·02 cases; 1927–28, 2·02 cases, per tree.

(10) Villa Franca on rough lemon: The trees have not made very satisfactory growth, but are cropping well for the size of the trees. The fruit is a good average quality. Crop, 1926–27, 4 cases; 1927–28, 2 cases, per tree.

(11) Villa Franca on *Citrus trifoliata:* Very dwarfed trees and small fruit. Crop, 1926–27, 1·05 cases; 1927–28, 1·01 cases, per tree.

(12) Villa Franca on Rangpur lime: The growth of the trees is very similar to No. 10. As already mentioned, the nipple has not grown out on many of the fruits, making the lemons almost spherical in shape and badly wrinkled at the nipple end. This failing may disappear as the trees get older, as has already happened with this variety on the other stocks under test. Crop, 1926–27, 3·02 cases; 1927–28, 2·03 cases, per tree.

(13) Messina on rough lemon: The trees have not made very satisfactory growth, but are producing fair crops of medium-quality fruit. Crop, 1926–27, 3 cases; 1927–28, 2·02 cases, per tree.

(14) Messina on *Citrus trifoliata:* The trees are all extremely dwarfed and useless. Crop, 1926–27, 1 case; 1927–28, 0·07 case, per tree.

(15) Messina on Rangpur lime: Stronger growth has been made by these trees than No. 13; the quantity and quality of the fruit is about equal. Crop, 1926–27, 3 cases; 1927–28, 1·07 cases, per tree.

(16) Messina on sweet orange: The trees and fruit appear to be the same in every way as No. 13. (Crop records for these trees are not available).

(17) Genoa on rough lemon: Medium growth has been made by the trees, and they are bearing good crops for their size. The fruit from these trees, and from No. 18, has a more attractive appearance than any other grown in the area. It is particularly even in size and shape, and has a very smooth rind. Crop, 1926–27, 4 cases; 1927–28, 2·02 cases, per tree.

(18) Genoa on *Citrus trifoliata:* Trees extremely dwarfed and practically useless. Crop, 1926–27, 1·05 cases; 1927–28, 1 case, per tree.

(19) Genoa on Rangpur lime: The growth of these trees and the appearance of the fruit is practically identical with No. 16, but the crop has been lighter. Crop, 1926–27, 2·06 cases; 1927–28, 1·02 cases, per tree.

(20) Genoa on sweet orange: This stock does not appear to be so suitable for the Genoa variety as either the lime or rough lemon. Neither the growth of the trees nor the appearance of the fruit is equal to No. 16 and No. 18. (Crop records for these trees not available.)

Summary of Lemon Tests.

The results obtained so far from the different lemon variety and rootstock tests indicate that the three most suitable lemon-trees to grow for commercial purposes—in the locality of Tauranga, at least—are Lisbon on Rangpur lime or sweet orange, Genoa on rough lemon, and Eureka on rough lemon stocks. While the yields recorded above show that the crop for the past two seasons has been lighter on the Genoa than on either the Lisbon or Eureka, it must be borne in mind that the appearance of the Genoa fruit is better than that of either of the other two varieties.

Orange Varieties and Stocks.

Best's Seedless.—This is an extremely vigorous grower, but so far it has proved a very light cropper, and the trees are very thorny. The trees on sweet-orange stocks have not borne more than about a dozen fruits each in any one year. The one tree on Rangpur lime stock produced 0·05 case of fruit in each of the past two seasons, the fruit being all very large. Age of trees, ten years from planting.

Ruby Blood.—These trees are all on sweet-orange stocks, and have made medium growth. For several seasons past they have borne heavy crops for the size of tree. Much of the fruit does not attain the most desirable size for marketing. Age of trees, ten years from planting. Crop, 1926, 2 cases; 1927, 0·05 case, per tree.

Washington Navel.—The trees worked on sweet-orange stocks are making medium growth, and bearing heavy crops for the size of the trees. The fruit is a good medium size. The trees on Rangpur lime stock are dwarfed and the fruit very small. Age of trees, on Rangpur lime stocks, 9 years, and on sweet orange, ten years, from planting.

Crop, 1926, 2·05 cases on sweet-orange stock, and 1 case on Rangpur lime stock; 1927, 1·05 cases on sweet-orange stock, and 0·05 case on Rangpur lime stock.

Navelencia.—The trees are all on sweet-orange stocks and are making good growth. At the time of writing they are carrying a heavy crop of fruit of good commercial size. So far this variety has set a heavy crop only every other year, and in the off season only a few fruits have set. Age of trees, ten years from planting. Crop, 1926, 3 cases per tree; 1927, practically nil.

Thompson's Improved (Navel).—The trees on sweet-orange stocks have made good growth, and the fruit is a good commercial size. The trees on Rangpur lime stock have not made quite such good growth as those on the orange stock. The present (1928) crop is heavier on the Rangpur lime stock, but the fruit is smaller. This variety, like the Navelencia, has so far cropped only every other year. The age of some of the trees is ten years, and others eight years from planting. Crop, 1926, 2·05 cases per tree; 1927, practically nil. The crops were the same on both stocks.

St. Michael.—There is no appreciable difference in any way from the trees on sweet-orange stocks as compared with those on Rangpur lime stocks. The tree-growth in both cases is not as vigorous as that of most other varieties, and the fruit does not attain the most desirable size for marketing. The heavy crops borne by these trees for a number of years past has no doubt been responsible in a considerable measure for the poor tree-growth. The age of some trees is ten years, and of others eight years, from planting. Crop, 1926, 3 cases; 1927, 1·05 cases, per tree. The crops were the same on both orange and lime stocks.

Joppa.—The trees are all on sweet-orange stocks and have made good average growth, but so far have not borne a heavy crop. The fruit is small. Age of trees, ten years from planting. Crop, 1926, 0·05 case per tree; 1927, practically nil.

Jaffa.—These trees (also all on sweet-orange stocks) have not made quite such good growth as the Joppa variety. So far the trees have set only a very light crop, and the fruit is small. Age of trees, ten years from planting. Crop, 1926, 0·05 case per tree; 1927, practically nil.

Poorman.—Every tree of this variety in the test area is now bearing a heavy crop of good-type, large-size fruit. The trees on sweet-orange stocks have made excellent growth; those on Rangpur lime stocks are a little larger than those on the sweet-orange stock, in spite of the fact that they came into bearing a year sooner. While there is no great difference between the results obtained on the respective stocks, there can be no doubt that the Rangpur lime is preferable—for Tauranga conditions at least. Age of trees, ten years from planting. Crop on sweet-orange stock, 1926, 3 cases; 1927, 1·02 cases, per tree; crop on Rangpur lime stocks, 1926, 3·02 cases; 1927, 1·02 cases, per tree.

Valencia Late.—There is one tree only of this variety, and no records are available of its crop or age. It is probably not less than eighteen years old, and has borne heavy crops of fruit for many years. At the present time this tree is carrying in the vicinity of nine cases

of oranges. A good deal of the fruit is on the small side. The chief point in favour of this variety is the fact that the fruit will hang on the trees very much longer than with any other variety, and without losing its juice content.

Other Citrus Fruits.

March Seedless Grapefruit.—The trees are all making good growth, and have borne a medium crop of large-size fruit for several years past. The rind and pith of the fruit are very thick. Age of trees, nine years from planting.

Emperor Mandarin.—There is one tree only of this variety, which is now three years old from planting and is on sweet-orange stock. Unfortunately, this tree was severely injured soon after planting by being run over with disks; consequently poor growth has been made. This season the tree has produced about two dozen fruits, all of medium size.

Sampson Tangelo.—These trees (two only) were poorly grown and badly rooted when secured from the nursery a year ago. This fact, in conjunction with the exceptionally dry weather experienced during the past year, has resulted in very poor growth having been made by the trees. They were pruned before planting.

Ellendale Beauty Orange, Foster Grapefruit, Golden Nugget Orange, and Meyer Lemon.—There are only two trees of each of these varieties. The condition and age of all is the same as that of the Sampson Tangelo trees.

THE CHRISTOFLEAU METHOD OF ELECTRO-CULTURE.

THIS matter was brought up in the House of Representatives last month by Mr. H. Atmore, member for Nelson, who addressed the following question to the Minister of Agriculture: "Whether he can inform honourable members as to the value of the Christofleau method of electro-culture, on which large sums of money have been expended by orchardists and tomato-growers in installing the apparatus? (Note.—If the apparatus is known by experience in other countries to give valuable results to the worker on the land it is suggested that the fact should be made known, and that if it is of no use the agricultural public should be informed of the position.)"

The Minister replied as follows: "Experiments with this method of electro-culture have been carried out in New Zealand, but no benefit appears to have been derived from the process. This confirms information received from the authorities in Paris that the actual capacity of such apparatus to bring into play appreciable quantities of electrical energy capable of influencing the crops is practically nil, and that there is absolutely nothing to sustain the statements and declarations given in the explanatory pamphlets issued in connection with it, these being in direct opposition to the fundamental laws of electricity."

Bush-sickness Treatment.—In the *Journal* for June, 1928, page 403, "Farmer P" gave the result of his experience with citrate of ammonium and iron for the treatment of bush sickness in cattle. He wishes to correct an error which crept into the transcript of his notes. Instead of one heaped teaspoonful plus 2 quarts of bran being the dose used, this is the mixture made, the dose being one handful of this mixture.

ESTABLISHMENT OF BENEFICIAL INSECTS IN NEW ZEALAND.

SUMMARY OF RECENT WORK UNDER AGRICULTURE DEPARTMENT.

THE following notes provide a summary of the biological control operations of the entomological branch of the Fields Division during the year ended March, 1928. The work was under the control of Dr. D. Miller, then Government Entomologist attached to the Department of Agriculture, who has since resigned to take up the position of chief entomologist to the Cawthron Institute, Nelson. The summary was prepared by Dr. Miller.

Pear-midge Parasite.

The work of establishing the pear-midge parasite* referred to as Platygaster (*Misocyclops marchali* Kieff), was continued during the 1926–27 and 1927–28 seasons. The 1926–27 consignment from Europe gave most satisfactory results and enabled the establishment to be carried out on a sufficiently large scale.

In the autumn of 1927 the parasite was recovered in small numbers in the field at Henderson, near Auckland, in orchards where liberations had been made earlier in the season. In the spring of 1927 a very decided increase of parasites was noted in the field, correlated by marked improvement in the health of the trees and a decrease of midge infestation. As the season advanced, and until the autumn of 1928, the parasites were recovered in increasingly greater numbers. An outstanding feature was that in the spring of 1926, three female and one male parasites were liberated in an orchard at Stoke, near Nelson; and from midge-infested leaves collected in that orchard during January, 1928 (fifteen months later), large numbers of parasites were reared. It can be definitely stated that *M. marchali* is now well established at Henderson and at Stoke.

During December and January last large quantities of midge-infested foliage were collected from the Henderson orchards where the parasite is established, and distributed throughout the midge-infested areas of the Dominion. In localities outside the fireblight areas the adult parasites, and not the insect-infested pear-leaves, were distributed.

Sheep Maggot-fly Parasite.†

Owing to the influence of *Mormoniella brevicornis*, the rearing of *Alysia manducator* in the Department's insectaries received a serious setback until steps were taken to eliminate this secondary parasitism. The method employed was to give the larvæ parasitized by *Alysia* protection during pupation from the attacks of *Mormoniella*. In the cages used meat containing blow-fly larvæ exposed to *Alysia* was placed on earth about 1 ft. deep; the mature larvæ burrowed deeply

* The following former articles on the subject have appeared in this *Journal*: Vol. 32, pages 379–393 (1926); vol. 35, pages 107–111, and pages 170–175 (1927).

† For previous articles see this *Journal*, Vol. 34, pages 1–4; vol. 35, pages 219–220 (1927).

into this, mostly to the bottom of the earth, and there pupated. By this means *Alysia* was successfully reared in abundance and field liberations made during January, February, and March last.

For the successful arrival in New Zealand of the pear-midge and maggot-fly parasites thanks are due to the Director of the Imperial Bureau of Entomology, London, who was responsible for the location and collection of the parasites through the agency of Dr. J. G. Myers and Dr. R. C. Fisher.

Gum-tree Weevil Parasite.

As has been already recorded,* an egg-parasite (a species of Mymarid) was imported from Australia in October, 1927. The parasites reared from this consignment were used to infest weevil-eggs in the insectary, and from these, one month to six weeks later, the first New-Zealand-reared Mymarids were secured. So numerous were these Mymarids that most were liberated in the field, while the remainder were used to infest eggs in the insectary for future supplies.

The Mymarids were liberated at the following places: Henderson, Mangaiti, Orini, Waitapu, Waipukurau, Bulls, Marton, Palmerston North, Wellington, Blenheim, Motueka, and Darfield.

Grass-grub Parasite.

In New Zealand the grass-grub (*Odontria zealandica*) holds the same position as the June beetles and cockchafers do in North America and Europe respectively.

As the New Zealand grass-grub is remarkably free from infestation by parasites, it was decided to attempt the establishment in New Zealand of one or more of the parasites infesting Melolonthid larvæ in North America or Europe. As a preliminary step towards this development Dr. Arthur Gibson, Dominion Entomologist of Canada, was communicated with regarding the collection and shipment to New Zealand of June-beetle larvæ (*Lachnosterna* sp.) infested by larvæ of the Tachinid *Microthalma michiganensis*. Though this Tachinid and its host take two or more years in their development, and the New Zealand grass-grub one year, it was thought that the Tachinid might possibly adapt itself to New Zealand conditions, since in Canada it has been found at times to develop in a much shorter period than normally required.

Through the great generosity of Dr. Gibson three consignments of Tachinid-infested *Lachnosterna* larvæ have been sent to New Zealand. The material was collected by Dr. C. E. Petch, of the Canadian Government Laboratory, at Hemmingford, Quebec. In connection with the transport of the shipments we are much indebted to Mr. W. A. James (New Zealand Government Agent at Vancouver), to the Union Steamship Company of New Zealand, and to Mr. George Harnett (Port Fruit Inspector, Auckland).

Each consignment consisted of a number of tin-lined wooden cases containing numerous tins each enclosing a larva among earth. The small tins were placed in layers and separated by damp moss. Each

* See this *Journal*, vol. 35, pages 283–289 (1927).

consignment was sent in cool storage in the vegetable chamber of the ship. The first and second consignments, consisting of 1,060 larvæ in five cases, arrived in New Zealand in October, 1926. The larvæ were removed from the tins and placed in damp soil in well-ventilated emergence cases. A total of three Tachinids (all males) emerged during January, 1927, from both these consignments; two adult *Lachnosterna* also emerged.

The third consignment was received during December, 1927, and consisted of 1,800 larvæ in six cases. As with the first and second consignments, a number of the larvæ were found in a rotting state, and counts were made of the unhealthy and healthy specimens; the percentage of healthy larvæ in each of the six cases was as follows:—First case, 75; second, 80; third, 80; fourth, 79; fifth, 78; and sixth, 80 per cent. This illustrates a remarkable constancy in the health of the larvæ. The unhealthy ones, perhaps, were infected to some extent by a bacterial disease that causes mortality among the larvæ in Canada. Attempts were made to rear this pathogen, in the hope that it would be of use against the New Zealand grass-grub, but unsuccessfully.

When the third consignment was unpacked on 16th December, 1927, Tachinid puparia were found beside the remains of their host. The adult Tachinids commenced to emerge on 17th January, 1928, and continued until 31st March, a total of 103 being secured. On 17th January only one adult emerged, and another on the 24th. But from 25th January until 21st February the maximum emergences took place almost continuously, amounting to eighty-four in all. From the 22nd to the end of February three adults emerged. On 2nd and 5th March respectively ten emerged; on the 9th two, and finally one on the 30th and 31st. Adults lived in captivity for a period of eight days.

Field liberations of Tachinids were made in the Hutt Valley, Wellington (27/2/28), at Ashburton (1/2/28), and at Hororata, Canterbury (7/2/28); while others were liberated on 22nd February, 1928, in a large cage over pasture artificially infested with grass-grub.

Apart from the future of this Tachinid in New Zealand, an important feature of the attempted establishment is that material collected in the Northern Hemisphere during late autumn, when hibernation is about to commence or has already set in, can be shipped to New Zealand under moderately cold conditions for a period of four weeks, and that when submitted to summer conditions in the Southern Hemisphere both Tachinid and host develop to the adult stage without necessity for prolonged hibernation.

In relation to future attempts at the biological control of the New Zealand grass-grub, possibilities lie in the use of certain parasites of the Japanese beetle having a yearly cycle, and in the Mololonthid parasites of Australia and Europe. The Australian parasites have the advantage of existing under seasonal conditions similar to those of New Zealand, and in being nearer at hand.

The Kea Subsidy.—During the financial year 1927–28 the Agriculture Department's subsidy of 5s. per beak for destruction of the kea was paid on 3,053 birds, totalling £763 5s.—practically the same amount as in the preceding year.

GRADING OF EXPORT BUTTER AND CHEESE.

LEADING DAIRY-FACTORY AVERAGES FOR YEAR 1927–28.

Dairy Division.

LISTS of butter and cheese factories which have obtained for their export produce an average grade of 93 points or over for the past dairy year—1st August, 1927, to 31st July, 1928—are here presented. It is satisfactory to note that, despite the exceptionally dry, hot summer experienced, the quality of butter has been well maintained, the number of butter-factories averaging 93 points and over being three in excess of the 1926–27 list. Cheese quality, however, has not been fully maintained. Contributing factors towards this have been the abnormal summer conditions, and the cessation of the payment made by the Dairy Produce Board of a premium of ¼d. per pound for "Finest" grade over and above that for "First" grade. Only twenty cheese-factories figure in this year's list, as against sixty-eight in last year's.

Company or Proprietor.	Registered No.	Brand.	Average Grade.
BUTTER-FACTORIES.			
Rangitikei	1360	Rangitikei	95·039
Wangaehu	1326	Wangaehu	94·774
Wairoa	1345	Wairoa	94·667
Waitaki	812	Waitaki	94·658
Taieri and Peninsula (Dunedin)	54	Taieri and Peninsula	94·574
Rata	938	Rata	94·526
Awahuri	664	Red Rose	94·364
Levin	910	Levin	94·331
Shannon	1489	Shannon	94·260
Golden Coast	991	Golden Coast, &c.	94·197
Napier	169	Clive	94·166
Mangorei	345	Mangorei	94·147
Tolaga Bay	1007	Tolaga Bay	94·092
Midhirst	110	Rugby	94·050
Lepperton	49	Lepperton	94·036
Pio Pio	603	Pio Pio	93·977
Moa Farmers'	341	Inglewood	93·972
Kiwi	299	Kiwi	93·970
Kia Ora	926	Kia Ora	93·960
Rongotea	8	Rongotea	93·936
Kokotahi	1144	Kokotahi	93·917
Rangiwahia	750	Quail	93·896
Masterton	1307	Masterton	93·814
Okau	872	Okau	93·807
Raetihi	717	Raetihi	93·798
Waitara	726	Waitara	93·788
Heretaunga	1230	Heretaunga, &c.	93·750
Maketawa	342	M.D.C.	93·746
Farmers' Dairy Federation	336	Murihiki	93·734
Waipukurau	1455	Mount Vernon	93·711
Golden Coast	387	Golden Dawn	93·689
Tarata	631	Tarata	93·680
Golden Bay	146	Sovereign	93·636

Company or Proprietor.	Registered No.	Brand.	Average Grade.
BUTTER-FACTORIES—*continued.*			
Taihape	1188	Tikapu	93·626
Bell Block	488	Bell Block ..	93·606
Palm	1838	Palmerston ..	93·556
Cheltenham	3	Pakeha	93·552
Kaikoura	302	Kai	93·534
Uruti	300	Uruti	93·534
Tarurutangi	728	Champion ..	93·519
West Coast Farmers'	675	Silver Pine ..	93·508
Tariki	1818	Tariki	93·462
Norsewood	600	Norsewood ..	93·454
Tamaki	1356	Bell	93·435
New Zealand (Ngatea)	291	Anchor, &c. ..	93·434
Murchison	1888	Airship	93·410
Tikorangi	102	Shield	93·400
Sefton	28	Star	93·373
United	1296	Whariti	93·359
Arahura	1516	Arahura	93·355
Manutahi	495	Manutahi	93·326
Kairanga	1768	Longburn ..	93·312
East Tamaki	301	East Tamaki ..	93·293
Ruawai	66	Ruawai	93·288
North Taranaki	723	Flax	93·264
Taieri and Peninsula (Oamaru) ..	1234	Taieri and Peninsula	93·250
Mauriceville	14	Mauriceville ..	93·243
Omata	82	Omata	93·241
Ormondville	735	Ormondville ..	93·185
Kuku	905	Ohau	93·169
Caroline	236	Caroline	93·144
New Zealand (Waiuku)	111	Anchor, &c. ..	93·086
Farmers' Dairy Federation ..	165	Gore	93·068
Co-operative Dairy of Otago ..	266	Huia	93·063
Whakaronga	1709	Whakaronga ..	93·052
Stratford	68	Good Luck, &c. ..	93·026
Cambridge	1239	Cambridge ..	93·019
Kaipara	794	Poplar	93·007
Wellington Municipality ..	202	Rahui	93·007
CHEESE-FACTORIES.			
Hopelands	1178	Hopelands ..	93·755
Little Akaloa	32	Little Akaloa ..	93·745
Milton	1030	Milton	93·742
Omimi	74	Omimi	93·738
Kaiparoro	619	Bruce	93·734
Dalefield	9	Dalefield	93·461
Tamaki	1463	Tamaki	93·431
Wellington Dairy Farmers' ..	252	Onward	93·314
Collingwood	1742	Collingwood ..	93·287
Carrington	621	Carrington ..	93·287
Waimana	1817	Waimana	93·269
Staveley	1719	Staveley	93·264
Woodville	1892	Woodville ..	93·190
Temuka (Co-op.)	207	Ohape	93·111
Rapanui	1714	Southern Grove ..	93·109
Pahia	707	Pahia	93·065
Tamaki	58	Tamaki	93·039
Paraparaumu	167	Pram	93·017
Momona	1010	Momona	93·017
Browns	925	Browns	93·015

SEASONAL NOTES.

THE FARM.

ROOT AND FORAGE CROPS.

DURING recent years there has been a slow but steady decline in the area devoted to root and green forage crops, and this decline is largely attributable to the rapid expansion of the practice of top-dressing grassland with phosphatic fertilizers. Top-dressing has been the means of greatly improving the amount and quality of the feed produced by pastures, and in dairying districts the conservation of some of the surplus summer production of grass as hay and ensilage for feeding during periods of grass-shortage has rendered less necessary the growing of roots and green forages for autumn and winter feeding.

Soft turnips, swedes, and rape are still, however, necessary grass-supplementary crops in the arable farming districts of New Zealand, where low summer rainfall and low winter temperatures are the limiting factors in the production of grass pastures. Also on many North Island dairy farms the pasture-land has not yet been brought to a sufficiently high state of fertility to allow of the annual grass-supplementary crops being entirely replaced by hay and ensilage. The successful adoption of really intensive grass-farming methods on dairy farms will depend on there being available a large reserve supply of grass ensilage and hay to tide the herd over any period of particularly poor grass-growth.

On many farms the growing of roots and green forage crops is a necessary step in the improvement of the pasture-land, and their production for some years will allow of a good reserve of hay and ensilage being accumulated prior to the adoption of more intensive grass-farming methods.

Land intended for root and forage crops should be brought to a good tilth before sowing—and by "a good tilth" is meant a seed-bed that is clean, sweet, moist, fine, firm, and deep. The main points to be observed in ploughing the land for root and forage crops were outlined in last month's notes, and the tillage work during October and November should aim at securing a seed-bed that is fine from top to bottom, at preventing the loss of moisture, and at refirming the soil prior to sowing so as to restore the moisture connection with the sub soil and bring up supplies for the use of the seed and the young roots.

It is very important that the seed-bed should be fine from the top to the bottom. A superficial pulverization that leaves the lower part of the seed-bed cloddy is very unfavourable to crop-growth. Large clods in the lower layers of the soil prevent the rise of moisture, and when the clods break down, as they finally do, the soil often lacks the degree of firmness that is necessary for good growth. On heavy land it is necessary to use the spring-toothed cultivator to bring the clods to the surface, where they can be dealt with by the roller and disks. The cultivator, besides bringing the clods to the top, shakes

the fine soil to the bottom, where it will form a continuous layer with the unmoved subsoil through which moisture from the lower levels can reach the surface.

The main sowing of root and forage crops takes place in November, but when large areas are sown it is always advisable to sow in breaks, and in favourable districts the first break of soft turnips and rape can be sown towards the end of October. Mangolds are often sown in October, but in any year when that month is cold and wet the sowing should be delayed until November.

PASTURE MANAGEMENT.

As referred to in recent notes, much more intensive methods of farming grassland seem likely to be undertaken on dairy farms in the near future. Intensive grass-farming consists in close subdivision, regulated stocking, and heavy manuring. Grass is treated as a crop—the pasture being allowed to reach a height of 4 in. to 5 in., quickly grazed down, and then spelled till the next crop of young grass is ready. No definite rules can be laid down governing the exact stage at which pastures should be grazed by milking-cows. A good deal depends on the completeness with which the pasture was grazed and harrowed prior to shutting up. If the grazing was uneven the pasture may have a general growth of 2 in. to 3 in., while in parts it is 5 in. to 6 in. high, and when this is so it is best grazed at this stage before the higher growth gets rank.

The success of intensive manuring of grassland depends very largely on the completeness with which pastures are grazed and harrowed before being shut up. The milking-cows should be followed by young stock and horses, to graze the pasture down to a close, even sward. Where there are not sufficient young stock on the farm to clean up the growth after the milking-cows, it is possible to use the cows themselves to do the final grazing by allowing them to graze after each milking in a new pasture for one to two hours, and then moving them off into the pasture on which they have just finished the best grazing and using them to clean up the remaining growth. It is very necessary to closely graze the pastures prior to harrowing and shutting up if a good even growth is to be obtained.

Many dairy farms are not sufficiently subdivided to control the summer growth by grazing and by conserving some of the surplus growth as hay and ensilage, and in such cases the use of the mower is still necessary to keep the growth short. On many farms the mowing of the rank growth is left rather late, not being done till January or February. Early mowing is important, because the autumn growth of grass is thereby increased.

REPAIR OF IMPLEMENTS.

Ploughs on arable farms are in constant use from January to September, but after ploughing the land for spring- and summer-sown root and forage crops they are not used to any extent until December or January, when a start must be made on skim-ploughing grassland for autumn wheat or breaking up stubbles for autumn catch-crops. It is a good plan to always overhaul implements immediately after the seasonal work is finished, and when any faults that have manifested

themselves during work are fresh in mind. The system of lubrication should be overhauled, skeiths adjusted, and any other necessary repairs made.

Grass-mowers should be overhauled and put in readiness for cutting hay and ensilage in November and December. Worn ledger-plates should be renewed, broken knife sections replaced, and the fingers adjusted so that there is close contact between the knife sections and ledger-plates. One cause of bad cutting in mowers is that the knife does not centre properly. When the knife is at the end of its outward or inward stroke the knife section should lie in the centre of the fingers; if the sections do not centre the cut is ragged and the draught is increased. This defect is usually due to the pitman not being of correct length. Most metal pitmans allow of adjustment. Another cause of this defect is that the bar is out of alignment, which may have been caused by bending after striking some object or from continuously cutting round corners. Besides causing bad cutting, a disaligned bar means severe wear on the knife-head.

—P. W. Smallfield, B.Ag., Fields Superintendent, Auckland.

THE ORCHARD.

SEASONAL SPRAYING.

DURING the period following the publication of these notes spraying for the control of pests and diseases will be the main consideration of the orchardist, and until the fruit of all varieties is well formed the work must necessarily be very exacting. Special consideration must be given to each variety, according to the stage of development and its susceptibility to the diseases against which control measures are necessary. Later on, however, it is possible under normal conditions to adopt a combination spray which may serve all varieties. In the meantime the development of the different varieties must be watched closely, and sprays applied at the correct stages if the best results are to be expected.

One may often be guided by previous experience, and a well-kept spraying-log is a very necessary and useful part of an orchardist's equipment. Such details as dates of application, varieties sprayed, materials, strength of mixtures, stages of development, and weather conditions may be noted at the time, and, later, further notes on weather conditions immediately following, together with results, may be added. Often it is found necessary to repeat a spraying if rain follows immediately, and it is never safe to hold rigidly to a set programme. One must be guided by weather conditions, and extra spray applications should be wedged in if thought necessary.

It is usual to apply at least two fungicidal sprays on apples and pears prior to the blossoming-period. The second application, applied when the cluster buds are well expanded and showing some colour, usually consists of lime-sulphur, 1–40–50, on apples, and on some varieties of pears such as Winter Cole and Josephine. Other pear varieties would be better with a second application of bordeaux, 3–4–50. On certain varieties of apples which may have suffered on account of

powdery mildew, 8 lb. to 10 lb. of precipitated sulphur in addition to the lime-sulphur is advisable at this stage. In certain localities and under weather conditions favourable for the development of black-spot it may be necessary to apply on apples a second "pink" spray of lime-sulphur, 1–60.

This will carry one over till the next stage—"petal-fall." As this is a critical period in the development of black-spot, there should be no delay in applying a protective spray, when about 75 per cent. of the blossoms have fallen. On varieties of pears subject to black-spot, bordeaux, 3–4–50, should be continued. Other pear varieties may receive lime-sulphur, 1–80, at petal-fall. More consideration must now be given to the treatment of apples, having regard to the tenderness of the variety and the possible effect on the crop, at the same time guarding against attacks of black-spot. At the petal-fall or calyx stage, lime-sulphur with one of the precipitated sulphurs added is beneficial. However, on certain tender varieties, such as Cox's and Dunn's, it would be advisable to refrain from using lime-sulphur. Lime-sulphur, 1–100, with the addition of 8 lb. precipitated sulphur to the 100 gallons, is a suitable combination at this stage. The precipitated sulphur, if used alone, should be applied at a strength of at least 10 lb. to the 100 gallons.

Insect pests must also receive consideration. The use of lime-sulphur may keep in check such pests as red mite and scale insects. However, poison sprays for codlin-moth grubs and leaf-roller caterpillars must be added to the petal-fall sprays on apples and pears. Arsenate of lead, at the rate of $1\frac{3}{4}$ lb. powder or 3 lb. paste to 100 gallons, must therefore be added. Attacks of apple leaf-hopper, which causes as much damage to foliage as attacks of red mite, must be guarded against. These insects must be fought while in the nymph stage, as it is impossible to control hopper by spraying when they have become winged. A close watch must therefore be kept, and Black Leaf 40, 1–800, added if the hopper is present. It is usual to add the milk from about equal weight of fresh burnt lime to that of arsenate of lead, after diluting the arsenate with water to prevent injury from any free arsenic which may be present.

The "dry-mix" sulphur spray is favoured by a number of orchardists, and may be used as a substitute where precipitated sulphur is mentioned. It is prepared as follows: Ingredients—16 lb. fine powdered sulphur, 5 lb. fresh rock lime, $\frac{1}{2}$ lb. casein. Wet the casein and dissolve it with $\frac{1}{4}$ pint of caustic soda solution (the stock caustic-soda solution is made by dissolving 1 lb. caustic soda in 1 gallon water); stir well and bring the mixture to a milk and make up to 1 gallon with water; sift the sulphur, and make it into a paste by adding the gallon of dissolved casein and as much more water as is necessary to bring it into the consistency of a creamy paste; slake the lime, and dilute the milk to 10 gallons with water; strain it into the spray tank; start the agitator and add the creamed sulphur, and finally make the spray up to 100 gallons with water.

Stone-fruit will require attention, chiefly for the control of brown-rot. The dry-mix sulphur has proved a decided control for this disease. Some growers favour lime-sulphur combined with precipitated sulphur. The following formula may be used: lime-sulphur, 1–130; precipitated sulphur, 6 lb.

ORCHARD SANITATION.

Orchard sanitation plays quite an important part in disease-control. Prunings should be burned at the end of the season. Old picking-boxes which have held moth-infected apples and pears are often left about packing-sheds and orchard, and are invariably found to contain cocoons. Infected fruit should be destroyed at the time of picking. However, such boxes as mentioned should be destroyed or sterilized.

MANURING AND CULTIVATION.

It is essential that orchard land should be brought into real good tilth early, as delays and the possibility of dry weather setting in before such work is completed will render attempts at reducing the land to a desirable state almost hopeless. Poor cultivation is soon reflected in the size and condition of fruit and in weakened foliage. Most orchards benefit by some form of manuring, and annual applications of fertilizers with occasional liming is an important factor in maintaining profitable production. In most cases artificial fertilizers will have already been applied. However, quick-acting phosphates may still be given with a good chance of securing the full benefit from their application. From 4 lb. to 6 lb. of high-grade superphosphate and 1 lb. to 1½ lb. sulphate of ammonia may still be applied. It may be noted here in connection with manuring that no soil analysis can give more than an indication as to the requirements in the way of manure. These can be better determined by experiment.

GRAFTS AND BUDS.

Trees will still be in a good condition for grafting, and the work should now be pushed on without delay and completed before the middle of October, before scions become too forward. Clean cutting, good binding, and exclusion of air about the union are essential points if success is to be obtained. Binding may be done with raffia or with strips of waxed cloth. In the former case grafting-wax is smeared round the graft. The popular method of reworking old stocks is by rind-grafting. The scion, consisting of a length of last year's growth, preferably the thickness of a lead-pencil, and shortened to three buds, is cut wedge-shaped; a short cut is made vertically through the bark of the stock, and the bark on one side of this cut is lifted carefully. The wedge-shaped scion is pressed down beneath the raised bark of the stock. One edge of the wedge portion of the scion is pared off while being prepared, and this edge will lie against the unlifted edge of bark on the stock when the scion is pushed home.

Stocks which have been budded, if not already attended to, should be cut down to above the bud, so as to force the dormant bud into strong growth. The usual practice is to cut within 2 in. of the bud and to remove the remaining stub about midsummer. The tender shoots arising from buds may require securing to sticks.

FRUIT IN COOL STORE.

Fruit in cool store should now be drawn on in quantity, and fruit which is intended for very long storage should be examined periodically for condition. Large-size Sturmers should be marketed early.

—N. J. Adamson, Orchard Instructor, Hastings.

Citrus-culture.

The principal work of the coming month will consist in pruning all trees and cultivation of the land. There will be found throughout the trees may fruit laterals which have become worn out, and quite a number of dead snags resulting from fruit twigs and laterals dying back. This season is a most opportune one to remove all such wood and cut back exhausted laterals to a sound bud, which will give replacement with newer laterals of a fruitful type. Particular attention should be given to the inside of the tree, for unless growths in these parts are well regulated by spacing and replacement a large proportion of the fruiting-area may be lost. Growths of a very succulent nature, and misplaced leaders or branches, should also be removed.

With renewed activity of the tree during spring good wood-growth may be expected, but it should be remembered that root-action is also active and extending at the same time, consequently cultivation of the soil should be attended to. Where this is neglected the habit of citrus-trees to form fibrous roots near the surface is encouraged, and such roots are of little value later in the season, being exposed to higher soil-temperatures and subject to excessive dryness. The trees consequently suffer when they most require moisture, making as they do their maximum demand on the soil during the period of minimum rainfall. It is not sufficient to cultivate deeper later on, as by so doing surface roots made early are destroyed. The aim should be to cultivate deeply (4 in. at least), digging right up to the tree, and continuous cultivation of this surface soil will confine the roots to a lower and more appropriate level, while at the same time conserving all possible moisture.

—W. H. Rice, Orchard Instructor, Auckland.

POULTRY-KEEPING.

END OF THE HATCHING-SEASON.

THE end of this season's period for hatching out chicks is now near at hand, and for this reason no further time should be lost in placing the last eggs into the incubator or under the natural mother. The late-hatched chick always commences its life under a severe handicap as compared with the early-hatched bird, which develops as the days lengthen, and thereby meets with those favourable conditions for promoting rapid growth and sound development. The drawbacks to late hatching are many, the chief being that the chickens have the midsummer heat to contend with, and are then subjected to the cold weather often experienced in the late autumn, before they are properly developed. The drawbacks to late hatching may be largely counteracted by placing the little birds under the very best conditions possible, such as in an orchard where good shade, shelter, and fresh ground are available.

The chickens should be encouraged in every way to develop without check. Only good wholesome grain food should be supplied. Green food is of special importance, and should be fed in abundance. Finely-cut succulent grass, lucerne, clover, watercress, lettuce, silver-beet leaves, or even young cabbage-leaves provide suitable green material for growing chickens. A constant supply of grit, charcoal, and clean

water should be kept before the young birds. Above all, the quarters should be maintained in a thoroughly sanitary state to ensure against insect pests making their appearance.

NON-ABSORPTION OF YOLK IN INCUBATED CHICKS.

It is one thing to hatch a chick artificially and another thing to rear it. A common mistake is to think that because chicks hatch out well and give every evidence of being perfect specimens it follows they will be reared successfully. For example, much mortality takes place in chicks when from three to six weeks old, due to the yolk which is drawn into the chicken's body just before it leaves the shell failing to digest. In such cases the yolk, instead of being gradually absorbed to provide nourishment for the chick during the first four days, as nature intended, gets into a more or less hardened state, when death sooner or later takes place—and this quite regardless of the birds being properly fed and managed. When this condition is disclosed by a post-mortem examination the cause of death will be made apparent. It is generally believed that failure of the yolk to become assimilated is due to feeding the chicks too soon after hatching, or to overfeeding during the first few days. It is also often considered that breeding from overfat hens is responsible. While these factors may have some bearing on the matter, experience goes to show that this trouble is due more to improper incubation than to any other cause. This is confirmed to a great extent by the fact that the trouble is seldom found in chicks that have been hatched by the natural mother. There it will be found (except, perhaps, in very isolated cases) that the yolk is in a more or less liquid state, which enables it to run freely and become easily assimilated. With incubator-hatched chicks the hardened yolk and its bad effect on the young bird is undoubtedly chiefly caused by having the temperature too high during the whole or a part of the incubating-period—half-baking, as it were, the yolk and rendering it incapable of absorption. I would again emphasize the advisability of opening up any chick that dies, in order to discover if possible the cause of death, and gain knowledge regarding preventive measures.

OVERSUPPLY OF MEAT-SUBSTITUTES.

While blood-meal and meat-meal are excellent substitutes for boiled meat for the purpose of promoting egg-production, there is a danger in overfeeding fowls with these concentrated foods. They do not require the same forcing-food in the present natural laying season as in winter, when egg-production is more or less artificially forced. The proportion of such materials as blood-meal and meat-meal should be reduced now, especially where the birds have a free range with opportunity, especially after rain, of picking up insects, worms, &c. In forcing egg-production animal food in some form is necessary, but in the natural laying season only a minimum quantity is required. If oversupplied then ovarian troubles such as protrusion of the oviduct and the production of double-yoked and shell-less eggs are apt to result.

DUCK-REARING.

October is a good period for hatching out ducklings for the renewal of stock. Under proper management ducklings rapidly develop, and

may therefore be hatched to advantage much later than chickens. Indian Runner ducks hatched out in October may be expected to lay during the next dear-egg season. Ducklings can be hatched by artificial means in a somewhat similar manner to that employed for chickens. The temperature during the period of incubation, at the level of the top of the eggs on the tray, should be 102° F. for the first week; from this on to the pipping stage 103°; and 104° when hatching. If the correct degree of temperature is maintained the ducklings will commence to pip on the twenty-sixth day, and hatch out on the twenty-eighth. Beware of the common mistake of trying to help the little birds out of the shell, until they have been given their full time to hatch. When once the eggs have commenced to pip the door of the incubator should not be opened until the hatch is practically cleaned up.

One of the secrets in hatching duck-eggs is the application of moisture. The best way of applying this is to spray water at a temperature of 103° with the mouth on the eggs every morning after the fourteenth day. Do this after turning, and immediately place the eggs back in the machine. Do not cool after spraying. Spray in the morning and cool at night.

Ducklings are much easier to rear than chickens. If success is to be attained, however, several points must be strictly observed. The young birds should not be fed for thirty-six hours to forty-eight hours after hatching. In the first week the food may consist of equal parts of scalded bran and pollard to which is added a small quantity of oatmeal and fine grit, not sand. Feed four times a day a quantity that the birds will pick up clean in about ten minutes. When the ducklings are about a week old the grit need not be mixed with the food, but it should be available to them in a shallow receptacle so that they can help themselves. As the ducklings grow older the oatmeal can be eliminated from the ration and maize-meal substituted. Well-boiled wheat makes a splendid change for growing ducklings. Finely cut green food, such as lettuce or young tender grass, should be fed separately after the first week, while a little boiled minced meat should be given and increased by degrees as the ducklings develop.

Water should be given with the first meal, and from then onwards it should be left in reach of the birds, both day and night. It is of the greatest importance that they be not given water after a long fast until they have received a meal. Even then it is a wise course to provide water with the chill taken off. When ducklings are given a cold drink before food, and especially if they have been confined in a brooder without food, they are almost sure to suffer from staggers, followed by heavy mortality. Ducklings thus affected give every indication of being in a fit, falling on their backs with eyes twitching, and presenting a generally distressed appearance. They will sometimes behave in a similar manner, and with serious losses, when enclosed in an overhot, badly-ventilated brooder. It should be always remembered that provision for an ample supply of fresh air at all times is one of the chief secrets in artificially rearing ducklings.

Although ducks are water-fowl, it is imperative for old or young birds that their sleeping-quarters be maintained in the driest possible condition, or leg-weakness and other troubles will result. After, say, three to four days the water-vessels should be placed in the

brooder-run, and well away from the sleeping-quarters, as a means of minimizing the wetting of the latter. At this stage the vessels should be of sufficient depth for the birds to wash off any food from their nostrils, and at the same time give them a good blow-out. If the nostrils are allowed to clog the eyes become plastered, while lameness, weak back, and an unthrifty condition soon sets in. It is important that young ducklings be provided with good shade during hot weather, as they are prone to sunstroke.

As is the case with chickens, young ducklings should be marked for future age-determination. The best way of doing this is to take a V-shaped piece out of the edge of the web of the foot. This should be done with a very sharp pen-knife, the foot of the duckling being held firmly on a piece of solid smooth board during the operation. Ducklings can be marked when leaving the incubator.

WHITE INDIAN RUNNER DUCKS.

Last year Mr. A. Wood, Grey Lynn, Auckland, the noted breeder of White Indian Runner Ducks (whose pen of three birds laid 989 eggs for one year, and team of six birds 1,891 eggs for the same period, at the Auckland egg-laying test of 1926–27) generously presented to the Department of Agriculture several sittings of eggs from his special strain. The eggs were hatched out at the Department's Wallaceville Poultry Station, with the result that the station is now possessed of a flock of high-class birds. They not only possess laying-qualities, but are also generally good types of their breed—beauty and usefulness being thus happily combined. Such stock should specially appeal to farmers. A limited number of sittings from this high-class stock are now available for disposal at 15s. a dozen, postage free. Applications should be made to the Poultry Overseer, Wallaceville Veterinary Laboratory (Private Bag), Wellington.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

SPRING FEEDING.

A CONSTANT watch should be kept on the stores in the hives. Usually at this period there is a steady drain on the food-supply to meet the incessant demand for brood-rearing. If an examination of the hives was carried out as advised in my July and August notes, then the losses attendant upon spring starvation will have been avoided; but it is not wise to neglect to feed where stores are now short, as the spring is the most critical period for the beekeeper. The weather conditions are not always favourable for the bees to work the early spring blossoms, and in populous colonies the food-supply should be augmented, but only where there is a noticeable shortage. If there is a good queen in the hive she will usually begin laying as fast as weather conditions will permit, and it is a mistake to start feeding unless stores are very short, as it stimulates brood-rearing, and when started must be carried on until a natural flow sets in from the fields.

Abundance of stores is certainly required at this season, and if the beekeeper finds that additional food is required it can be supplied in the form of combs of honey or as a syrup. The feeding of combs of honey should not be practised unless the beekeeper is sure that his apiary is free from disease, as there is always danger of spreading disease by this method. No better substitute for honey has been found than cane-sugar, and it is far safer to use it at all times if the beekeeper is not satisfied as to the health condition of his apiary. Honey from an unknown source should never be fed. There are many feeders on the market. The division-board feeder is the best to use at this season, as it will serve the double purpose of feeder and division-board in cases where the colony is not strong enough to occupy all the frames in the hive.

THE WATER-SUPPLY.

In the spring months, when brood-rearing is at its height, bees require a good supply of clean water in the apiary. If this is not provided they are apt to become a source of annoyance at drinking-troughs and by congregating round domestic supplies. Brood requires a great deal of water in addition to pollen and honey. The amount depends largely on how much brood-rearing is going on, and to what extent nectar is coming in from the fields. If water is not close at hand many bees are lost in trying to obtain it, more especially as the weather is often changeable and boisterous in the spring.

Many simple contrivances can be made to supply water. "Simplicity" feeders make excellent vessels for the purpose, but they require to be filled frequently. To start the bees taking water from any particular place it is a good plan to slightly sweeten the first water given.

UNITING COLONIES.

As advised last month, if weak colonies are found they should be united with stronger colonies. It is economy not to attempt to build them up. Place the weak colonies on the stronger colonies. It is well to remember that this is an important point in spring management.

CLEANING THE HIVES.

It is well to now take advantage of any settled weather to spring-clean the hives. Lift the hive off the bottom-board, and clean off the dead bees and other waste matter. The simplest way is to take a spare bottom-board, remove the complete hive, place a clean board on the stand, and then return the hive to its place. The operation may be carried out quickly, and without disturbing the bees. Scrape the debris from the old board into a tin and destroy by fire.

FOUL-BROOD DISEASE.

At all times when examining the combs a strict watch should be kept for symptoms of foul-brood. Beekeepers should never lose an opportunity of acquainting themselves with this disease in all its stages. At this season if isolated capped cells are discovered in frames which contain no other brood, these should be treated as suspect and subjected to the test for foul-brood. If on opening a cell, when a sharp-pointed piece of stick is inserted, the dead imago can be lifted out complete in form,

the beekeeper may conclude that if dry it is a case of starvation, and if moist a case of chilled brood. If, however, the contents of the cell adhere to the point of the stick in a ropy ill-smelling mass it may be concluded that the hive is diseased. There is perhaps no surer indication of the presence of foul-brood in the hive than the objectionable smell of the decayed larvæ. Beekeepers who once recognize this odour will have no difficulty in detecting the disease in that stage. The last and most difficult form of foul-brood is the dry stage, and in this form it has baffled beekeepers of long standing. Only a careful examination can reveal its presence. The diseased larva, having dried to a scale, adheres to the lower side of the cell, and can be removed by scraping with a sharp-pointed instrument. If the aforesaid isolated capped cells on being opened appear at the first glance to be empty, they will almost invariably yield a scale if examined, and the hive should be marked for treatment.

Wherever there is a fair yield of nectar from spring flowers the beekeeper would do well to take advantage of the warm days of the coming month to treat any cases of foul-brood which he may have noted earlier in the spring. However, no hard-and-fast rule can be laid down in this matter, everything depending on locality and weather conditions. In some districts it would be almost fatal to treat the bees in October; in others where right conditions prevail it may be carried out with ease and safety, and the bees brought into good condition by the time a surplus may be expected. Wherever treatment has been undertaken the colonies should be watched in order to see that there is no danger of starvation, and where the spring flow is not considered heavy enough it should be supplemented by liberal feeding. For full details regarding American foul-brood and its treatment see Bulletin No. 119, obtainable free on application from the Publisher, Department of Agriculture, Wellington, or from the district Apiary Instructor.

REGISTRATION OF APIARIES.

A reminder is necessary in the case of beekeepers who have failed to make application for the registration of their apiaries as provided by section 5 of the Apiaries Act, 1927. Prior to the present Act coming into force registration was required every third year. However, under the new Act registration remains operative as long as the same beekeeper occupies the same premises and continues to keep bees thereon. As the matter now stands every owner of an unregistered apiary is liable to prosecution without warning, and upon conviction is liable to a penalty not exceeding £20. Application for registration is to be made to the Director of the Horticulture Division, Department of Agriculture, Wellington. Registration is free, and on application being made in respect to any apiary there is issued, without charge to the person by whom the application for registration was made, a certificate. Any such certificate is *prima facie* evidence of the registration of the apiary to which it relates.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

THE MARKET-GARDEN.

THE half-hardy annual vegetables now demand the consideration of the planter; they include dwarf and runner beans, marrows, and pumpkins. These are very important crops, as they not only make excellent provisions during the summer-time, but they have first-rate storing-qualities, and require only the simplest accommodation to keep them throughout the winter months. Land from which spring cabbage and cauliflower are cleared will become available for these plantings towards the end of the month. The planting and sowing of all main crops, including the popular beetroot, should now be completed. The tomato crop outside is inclined to take precedence, but the useful lettuce is becoming increasingly popular, and on suitable land it will probably pay to start a crop now for the Christmas trade. Spinach is also a favourite delicacy, and a further sowing should now be considered. Feed the asparagus crop now and during the summer months by applying 2 cwt. to 3 cwt. of salt per acre per month, also the same quantity of fowl-manure desiccated and ground.

For planting out during December and January on land from which peas, potatoes, and other early crops have been cleared, sow towards the end of the month seed-beds of celery, autumn cauliflower, broccoli, Savoy cabbage, and leeks. This is a very important section, and where the land is suitable it will probably pay to give it careful consideration. For large crops sow the seed thinly in drills 1 ft. apart, and install the overhead watering system. Celery-plants grow best under moist shaded conditions, and brush or lath screens or a cheesecloth cover will be useful in helping to provide these.

TOMATOES, ETC.

The tomato is a half-hardy plant of the same natural order and geographical origin as tobacco, and its management in many ways is very similar. For outdoor planting the same hardening-off of the plants in frames should be carefully carried out. Before removing the plants from the boxes it is usually a wise precaution to give them a good bordeaux spray, carefully covering the stems and underside of the leaves. Where the market demand is prolonged almost into the winter, it is customary to make a late planting in December. For such a purpose a further sowing should now be made; it is unsatisfactory to retard plants for the purpose; plants that have received such a check are usually quite unsuitable for commercial cropping.

The warmer weather of October creates difficulties in the tomato crop growing under glass where ventilators are inadequate or lack attention. Leaf-mould (*Cladosporium*) now makes its appearance in such houses, and in the warmer districts is the cause of great losses. Strange to say, growers will spend money freely on all kinds of suggested remedies before they provide the increased ventilating-area required. A high temperature and close atmosphere suits some plants, but not the tomato, the foliage of which, if subjected to such conditions for any length of time, becomes soft and inefficient through the attacks of the fungus parasite. The ventilation of the glasshouse at this season, with rising outside temperatures and more than half the interior space

filled with foliage, is now at its most difficult and important stage; inadequate or excessive ventilation will seriously interfere with the valuable early crop. Under these conditions more water will generally be required by the plants, but chilling should still be carefully avoided by arranging to do the watering during the mild warmer weather.

Egg-plants and peppers are rather more tender than the average half-hardy plants. They should be hardened and planted out in the open, in stages a fortnight later than others. They should then be quite satisfactory in sheltered localities where tomatoes crop well.

BERRY FRUITS.

Brakes of berry fruits should be hoed occasionally in fine weather to keep the weeds down, and superfluous canes of raspberries and loganberries should be removed. Where hand-hoes are used much damage is often done by striking the butts of the bushes beneath the surface with the hoe. In the cuts so inflicted fungous growth is often established, and many plants are lost. On light land berry crops are sometimes a failure in a dry season. This could be overcome if some form of irrigation were arranged for use in an emergency.

MELONS AND CUCUMBERS.

Some very fine water and rock melons are grown in this country, and the demand is far from being supplied. Those growers who have warm, rich, friable soils that are moist could well give these crops more attention. Plants can be raised in paper pots on old hot-beds that have been used for tomatoes, or seeds may be planted out in the field 4 ft. apart and 6 ft. between the rows. Sometimes the seeds are sown in a slight depression and covered with a sheet of glass, but a cheaper method is to use a 16 in. square of waxed paper that is held up off the ground with a hoop of galvanized-iron wire, the edges of the paper being held in position with a little soil. When the plants are up and the weather mild the paper is lifted up on the lee side, and when the plant is sufficiently hardened it can be removed altogether and the papers burnt, while the wire hoops may be stored for future use.

Ridge cucumbers may be grown in a similar manner. In some districts sowing could be done towards the end of October.

THE TOBACCO CROP.

Preparations for planting out this crop in the field should be completed during October. Instructions for this work and other operations will be found in a special article on "Tobacco-culture" printed elsewhere in this issue of the *Journal*, which may take the place of the usual notes on the present occasion.

SPRING-TIME GARDEN FOES.

The combat with pests in the ground, on the surface, and in the air, that frequently causes the amateur to despair because the attack is unexpected, is usually brought to a successful issue by the experienced gardener who is observant and knows their ways. Common pests that feed upon roots and stunt the growth of plants in the ground are leather-jackets, the larvæ of crane-flies that love damp places; wireworms that

are the younger generation of click beetles; millipedes that are so often confounded with the friendly centipede which is carnivorous; and—perhaps the most common and difficult—the "grass-grub," the larva of the chafer beetle. Most dangerous on the surface of the ground at this time are the surface caterpillars or cutworms, the larvæ of various moths, which appear to be the embodiment of malignant mischief, as they cut young plants off neatly at the surface of the ground during the night, and just leave them where they fall. The insatiable appetite of slugs and snails is more honest and understandable. From the air the foes are various birds which in spring favour a salad diet combined with tender swelling seeds about to sprout. Successful cropping often depends on a good knowledge of the habits of these pests so that they may be avoided or dealt with effectually.

For subterranean pests fumigants may be used, such as carbon bisulphide, which can be supplied with a convenient injector; but such remedies are expensive and used only in special cases. Early and thorough cultivation affords a large measure of success, by disturbing the creatures when pupating, besides exposing others to their enemies—the birds—which eagerly search new-turned ground, especially during the winter. On some classes of heavy land even a fairly long fallow is a paying method. One of the best means of defence is a heavy dressing of kainit during the winter, followed by generous but discriminate use of nitrate of soda in the spring, which not only discourages the pests, but stimulates plant-growth, and so makes good the loss of roots.

Of pests that range the surface of the ground, the cutworm is readily checked by early and thorough cultivation of the land, and the combat is entirely successful if poisoned bran is broadcast towards the end of an afternoon, shortly before young plants are set out for the season. This bait is also successful in controlling slugs and snails, while another effective dressing for the two last-mentioned is powdered alum, alone or mixed with twice its weight of fresh slaked lime. But economy and results depend upon an intelligent use being made of these methods. They should be applied to plants subject to attack when observation has discovered the pest to be present; that is an economy. Furthermore, the application should be made just before or after the pest has emerged from its daytime hiding-place, according to the remedy used.

The bird pest is a very ancient trouble, but it is still the subject of correspondence with sufferers. The red-lead or kerosene treatment of seeds that are regarded as favourite bird-food is well known and efficient. For the protection of young seedling plants a dusting of soot or lime, or a chemical spray of lime-sulphur or bordeaux, will make the salad distasteful, and drive them away to dine on the crop of some gardener who is less attentive.

—W. C. Hyde, Horticulturist, Wellington.

Te Kauwhata Wattle Plantation.—During the last financial year 200 tons of green bark were harvested from the black-wattle plantation at Te Kauwhata Horticultural Station for sale to tanneries. A considerable amount of waste timber was sold as firewood, and timber-cutting on a royalty basis was continued. Gross revenue from the plantation amounted to £1,620.

WEATHER RECORDS: AUGUST, 1928.

Dominion Meteorological Office.

GENERAL NOTES.

AUGUST was, on the whole, a satisfactory month as regards rainfall, especially in view of the distribution during the preceding months. In most of the Auckland Province, where there was little need for it, the rain was below normal. In Nelson, and parts of Otago and Southland, too, there was a deficiency, and good rains will be needed soon in these districts, especially in the first one, if the season is to commence well. Elsewhere, registrations were mainly above the average, and much good will be done.

Most districts experienced remarkably uniform temperatures during the month, and the absence of extreme cold gave an effect of mildness even where the mean temperature was below the average. Growth has, on the whole, been good, and, although there is still some shortage of feed in some of the parts which experienced a very dry summer, conditions generally are favourable and stock and crops are doing well.

The month began with a continuance of the fine weather which had prevailed over the greater part of July. The rain-producing disturbances were of slight intensity in the New Zealand area until the 13th. A particularly fine spell was experienced from the 8th to the 11th, during which period the weather was controlled by a very intense anticyclone.

On the 12th the western districts were affected by a depression in the Tasman Sea which gradually moved eastward. On the 14th the trough of the depression lay across the Dominion, and a cyclone developed in its northern portion. The centre of the cyclone crossed the North Island from northern Taranaki to Hawke's Bay on the 15th, and then passed away eastward on the 16th. There were north-westerly gales in Cook Strait on the 13th, while on the 15th there were gales, generally from a southerly direction, at many places. At Wellington the southerlies were especially severe, and, combined with a high tide, caused much damage to the railway-line between Kaiwarra and Petone; shipping about Cook Strait was delayed, and minor damage of various kinds was done about the city. The period from the morning of the 13th to that of the 16th was a very wet one. The rain was general and there were many heavy falls.

Another storm of somewhat similar type passed during the 20th. There were northerly gales in Cook Strait during its approach, and fairly general southerly gales over the North Island on the 21st after the centre had passed. Again there was almost general rain. Gales and general rains were associated also with an intense southern depression which passed during the 23rd and 24th.

At the end of the month occurred the fourth and last of the important disturbances. This was an intense southern depression of the inverted-V type. Depressions of this type are usually followed by one or more secondaries, but there were none in this instance. The barometer fell rapidly to a minimum, and then commenced to rise again immediately with even greater rapidity. There were northerly gales during the 30th over much of the South Island, which changed suddenly during the evening to southerlies. The drop in temperature was very marked, and snow fell thickly on all the ranges at least as far north as Wellington Province. In South Canterbury and parts of Otago and Southland the snow reached the low levels, being particularly heavy in South Canterbury. Near Wellington it was low down on the Orongorongos and other nearby hills. The 31st was a brilliantly fine day over most of the area which received the snowfall, and there was a rapid thaw; very little loss of stock therefore resulted in the high country. Apart from the snow, there was fairly general rain in connection with this storm also.

—*Edward Kidson, Director of Meteorological Services, Wellington.*

RAINFALL FOR AUGUST, 1928, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average August Rainfall.
	North Island.				
		In.		In.	In.
1	Kaitaia	3·82	13	0·93	5·10
2	Russell	2·51	8	0·73	5·55
3	Whangarei	4·17	18	1·96	6·90
4	Auckland	3·34	24	0·78	4·19
5	Hamilton	2·52	15	0·53	4·02
6	Kawhia	3·09	13	0·66	4·54
7	New Plymouth	6·63	19	2·53	5·33
8	Riversdale, Inglewood ..	9·98	17	4·36	8·65
9	Whangamomona	5·55	11	1·26	5·83
10	Eltham	7·60	18	2·12	3·82
11	Tairua	2·80	15	1·12	6·33
12	Tauranga	1·54	12	0·31	4·08
13	Maraehako Station, Opotiki	5·58	13	2·36	5·20
14	Gisborne	4·95	14	1·42	4·55
15	Taupo	2·29	7	0·60	4·06
16	Napier	4·65	16	1·56	3·57
17	Maraekakaho Stn., Hastings	3·92	20	1·30	3·31
18	Taihape	3·30	16	0·47	2·73
19	Masterton	5·50	17	0·97	3·33
20	Patea	5·43	11	1·25	3·50
21	Wanganui	2·89	7	0·93	2·73
22	Foxton	2·76	9	0·90	2·89
23	Wellington (Karori Reservoir)	10·92	18	2·77	3·97
	South Island.				
24	Westport	7·08	19	1·46	6·27
25	Greymouth	8·04	19	1·71	7·53
26	Hokitika	12·44	19	2·14	9·34
27	Ross	16·42	15	4·51	10·40
28	Arthur's Pass	9·27	8	3·42	12·78
29	Okuru, Westland	6·31	7	2·16	11·46
30	Collingwood	5·97	16	1·76	6·96
31	Nelson	2·93	10	0·94	3·02
32	Spring Creek, Blenheim ..	2·80	11	0·80	2·73
33	Tophouse	3·65	7	1·85	4·64
34	Hanmer Springs	7·30	18	1·18	2·52
35	Highfield, Waiau	4·93	10	1·00	2·26
36	Gore Bay	6·28	9	2·80	2·12
37	Christchurch	1·83	12	0·66	1·83
38	Timaru	2·06	10	0·60	1·41
39	Lambrook Station, Fairlie ..	2·16	8	0·96	1·43
40	Benmore Station, Clearburn	3·63	9	1·46	1·45
41	Oamaru	1·58	9	0·53	1·71
42	Queenstown	2·30	7	0·83	1·93
43	Clyde	0·88	5	0·22	0·80
44	Dunedin	1·47	15	0·47	3·14
45	Wendon	1·60	8	0·44	2·26
46	Gore	1·21	11	0·27	2·31
47	Invercargill	2·48	19	0·36	3·31
48	Puysegur Point	8·96	21	1·12	7·20
49	Half-moon Bay, Stewart Is.	5·07	20	0·87	4·35

CERTIFICATION OF SEED POTATOES.

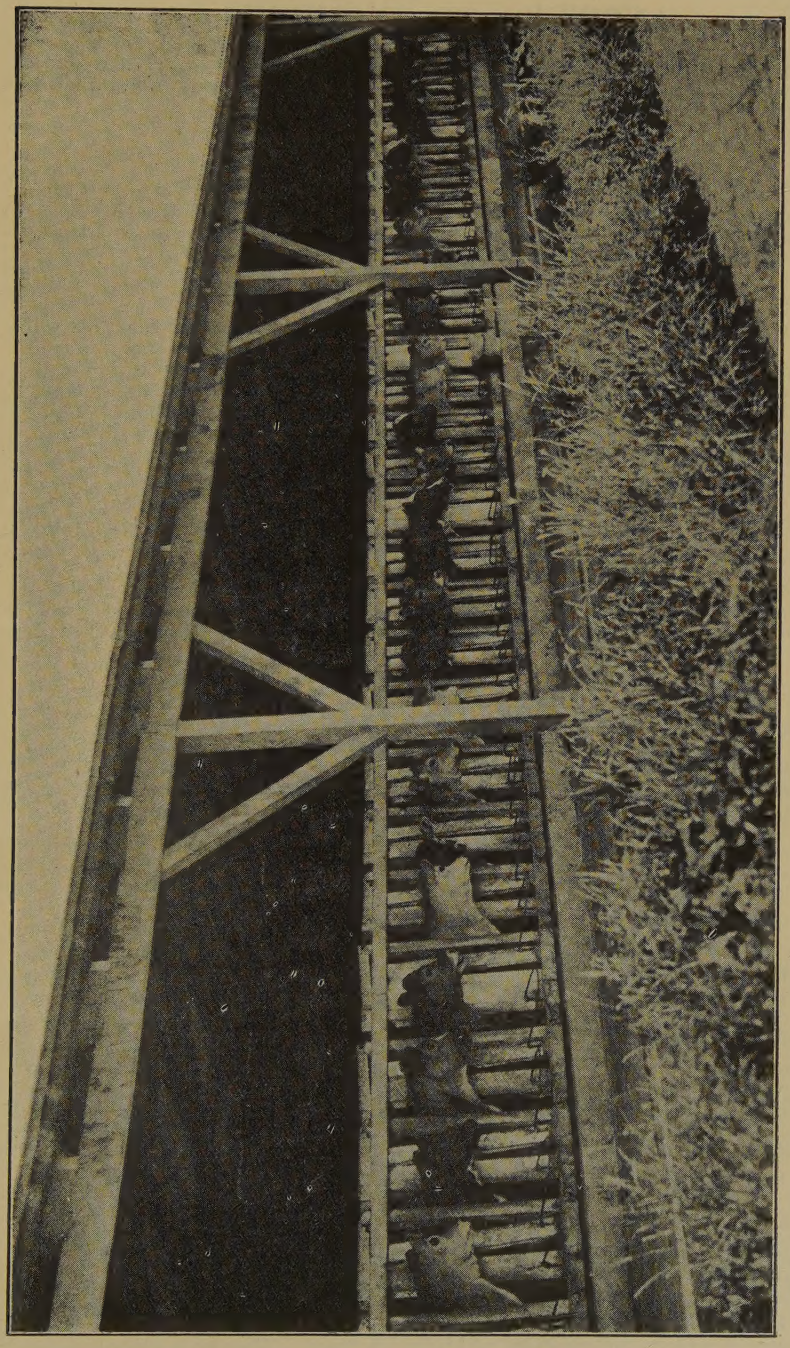
FINAL CERTIFICATES ISSUED IN CANTERBURY.

FOLLOWING is a list (up to 3rd September) of growers, who have been issued with final certificates by the Department of Agriculture under the system of Government certification of seed potatoes issued last season :—

		Acreage.
	Dakota.	
F. W. Carpenter	Prebbleton	19
J. Carr	Mount Hutt Rural, Methven	1
W. J. Crozier	Mount Hutt Rural, Rakaia	30
G. Hurst	Overdale P.O., Rakaia	4
W. McPhail	Mitcham, Mount Hutt Rural, Rakaia	13
C. E. Walker, jun.	West Melton R.M.D.	2
	Robin Adair.	
Muff Bros.	Orari	4
	Early Regent.	
W. Eder	Sefton R.M.D.	35
	Bresee's Prolific.	
J. Boag	Middlerigg, Brookside	2
F. W. Carpenter	Prebbleton	30
	Aucklander Short-top.	
F. Brundell	Camside, Kaiapoi	5
S. G. McCullough	Rangitira Valley, Temuka	3
W. E. Martin	Kaiapoi R.M.D.	9
A. J. Rich	Kaiapoi R.M.D.	10
	Aucklander Tall-top.	
J. Bailey	Kaiapoi R.M.D.	6
J. D. McMullan	Elmwood, Kaiapoi	8
A. J. Rich	Kaiapoi R.M.D.	5
	Arran Chief.	
A. Mortland	Templeton	10
F. A. Rollinson & Sons	Studholme Junction	20
F. Saunders	Studholme Junction	4
	Up-to-Date.	
C. E. Walker	Courtenay R.M., West Melton	6
F. Westaway	Courtenay R.M.D.	4

FERTILIZER IMPORTATIONS: JUNE QUARTER.

FOLLOWING are the importations of fertilizers into New Zealand for the three months ended 30th June, 1928 :—*Sulphate of Ammonia :* Australia, 139 tons; United States of America, 125 tons. *Calcium Cyanamide :* Belgium, 2 tons. *Basic Slag :* United Kingdom, 6,025 tons; Belgium, 28,853 tons; France, 1,068 tons; Germany, 11,715 tons. *Bonedust :* India, 29 tons. *Rock Phosphate :* Nauru, 40,514 tons; Makatea, 3,987 tons. *Phosphates (other) :* Morocco, 7,752 tons. *Superphosphate :* Belgium, 250 tons. *Kainit :* France, 114 tons; Germany, 90 tons. *Muriate of Potash :* France, 5 tons; Germany, 2 tons. *Sulphate of Potash :* France, 166 tons; Germany 166 tons. *Potash (other) :* France, 2,254 tons; Germany, 859 tons. *Sulphate of Iron :* Australia, 11 tons. *Other Manures :* Australia, 1 ton; Belgium, 20 tons; Germany, 18 tons; United States of America, 5 tons.



CALF-FEEDING TIME AT RUAKURA STATE FARM. [*Photo by H. Drake.*

The structure contains forty bails.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

EFFECT OF RAGWORT IN SILAGE.

B.R.H., Otorohanga :—

Could you please tell me the effect of ragwort in silage on dairy stock. This farm has a lot of ragwort, and I am told that it is very dangerous in hay, so wonder if it would be the same in silage.

The Live-stock Division :—

It is not known that the processes of fermentation which silage undergoes will destroy the toxic principles of ragwort, but, so long as the quantity is not excessively large, the ragwort would probably do no harm, because it would be so diluted that stock fed on the ensilage would receive only quite small amounts. We do not advocate making ensilage if one of the principal ingredients is to be ragwort. A better practice is to keep the weed in check by grazing with sheep, or by other recognized methods.

NON-MATURING FIGS.

"SUBSCRIBER," Masterton :—

I have a fig-tree, about ten years old and well grown, which bears a heavy crop of fruit; but when about half-grown the fruit begins to drop off, and never any of it reaches ripening stage. Can you suggest a cause or remedy?

The Horticulture Division :—

The variety of fig you are growing is evidently unsuitable for your district. Very possibly the fruit may mature if it were fertilized with pollen from the wild Capri variety, but a special insect is required that has not yet been successfully introduced into New Zealand. However, there are satisfactory varieties that may be grown here without such cross-pollination.

BEARING TROUBLE IN PREGNANT EWES.

R.C.H., Mangaweka :—

We are losing several ewes through the bearings coming out. Could you tell us what is the cause of this, and also give methods of preventive and remedial treatment.

The Live-stock Division :—

The condition in ewes commonly known as "bearing trouble" (extrusion of the vagina) is known to be induced by what might be termed a plethoric condition of the animal. It is seen more commonly in seasons when feed is good, when as a consequence the ewes do not get sufficient exercise in travelling for feed. The result is the ewe becomes sluggish, suffers from fatty infiltration of the liver, and urination is infrequent, causing distension of the bladder—conditions which lead up to extrusion of the vagina. In nearly all cases it is observed in ewes carrying twin lambs. Preventive treatment lies in enforcing exercise on the ewes by frequently changing them daily during the fortnight preceding lambing. If possible the change should be on to barer feed; but rousing up of the ewes, and keeping them on the move a few times daily, has the effect of stopping the trouble. Regarding treatment of individual cases: if seen early, the bearing can be successfully returned. The procedure is as follows: The operator washes his hands and arms in an antiseptic and then oils them. The ewe is placed on her side, the extruded membrane carefully washed with warm water which has been

previously boiled, and is slowly returned by the hand into the passage, followed up by the arm, which is kept there until warmth is restored. A few stitches are then inserted across the lips of the part, and the ewe kept from movement for a time. A dose of two teaspoonfuls of laudanum in a little gruel given to the ewe helps to prevent further straining. Treatment of the condition is, however, frequently difficult and disappointing. If the parts are swollen and congested it is very often hopeless. Prevention is the main objective.

BROKEN CROCKERY AND GLASS FOR POULTRY.

L. N. LAKE, Tauranga :—

Can you tell me whether crockery, glass, &c., put through a mill is good for ducks as well as hens? The hens appreciate it, but I have been doubtful about giving it to my ducks.

The Chief Poultry Instructor :—

It is on record that fowls have died from lead-poisoning as a result of eating certain kinds of crockeryware. In regard to broken glass, this is frequently passed in the droppings, and readily eaten again by the birds. It thus serves as ready means of spreading such a disease as tuberculosis, should any member of the flock be so affected, as the lesions are found almost invariably in the organs of the digestive system. Another drawback to broken glass is that the fine splinters are apt to become embedded in the birds' feet, causing corns, &c. Sharp stony grit as a means of assisting digestion, and freshly crushed sea-shell as an egg-shell-forming material, are recommended as best for both ducks and fowls.

MORTALITY AMONG LAMBS.

G. B. ELLIOTT, Tahuna :—

Would you please advise me of cause of and treatment for prevention in a trouble that I am having with some of my lambs. Lambs of perhaps two days to a week old sicken and die. The ewes in all cases have plenty of apparently good milk, and strong single lambs only seem to be affected. In a number of cases I have given the ewes other lambs with satisfactory results. I am running the ewes off as they lamb on to pasture that has been shut up for about a month before lambing. The grass is not particularly good, but in general the sheep are doing well. It is good country, fairly highly manured. The affected lambs do not seem to die in any pain, but just pine away, although they are dead in twenty-four hours after first showing signs of sickness.

The Live-stock Division :—

It appears probable that the cause of death is the ewes' milk becoming affected adversely by the change of pasture. The sudden change on to good pasture that has been manured and shut up for a month may upset the digestive organs of the ewe, and in consequence the lamb may become affected through the milk. The reason why the strong single lambs are affected is probably because these particular lambs are obtaining a larger quantity of milk and are thereby affected more than others. The trouble might be prevented by putting the ewes into pasture that is shorter and therefore more suitable for freshly-lambed ewes. It is well known that mortality may be expected among lambs whose mothers are put on to good feed with the object of pushing the lambs forward rapidly.

Noxious Weeds Orders.—The following special orders by local bodies, declaring specified plants to be noxious weeds within the respective areas of jurisdiction have been gazetted: Waimea County Council—broom, fennel, foxglove, gorse; Taihape Borough Council—hemlock; Milton Borough Council—broom, dock, elderberry, gorse, wild turnip. The Marlborough County Council has passed an order rescinding all by-laws and previous special orders declaring certain plants to be noxious weeds within that County.

AGRICULTURAL SHOWS, SEASON 1928-29.

THE following show-dates have been notified by agricultural and pastoral associations :—

Hawke's Bay A. and P. Society : Tomoana, 17th and 18th October, 1928.
Poverty Bay A. and P. Association : Gisborne, 23rd and 24th October.
Wairarapa P. and A. Society : Carterton, 24th and 25th October.
Timaru A. and P. Association : Timaru, 24th and 25th October.
Marlborough A. and P. Association : Blenheim, 24th and 25th October.
Manawatu A. and P. Association and Royal Agricultural Society of New Zealand : **Royal Show,** Palmerston North, 30th, 31st October, and 1st November.
Ashburton A. and P. Association : Ashburton, 1st November.
Northern A. and P. Association : Rangiora, 2nd November.
Wanganui A. and P. Association : Wanganui, 7th and 8th November.
Canterbury A. and P. Association : Christchurch, 8th and 9th November.
Egmont A. and P. Association : Hawera, 14th and 15th November.
Stratford A. and P. Association : Stratford, 21st and 22nd November.
Nelson A. and P. Association : Richmond, 23rd and 24th November.
Auckland Metropolitan A. and P. Association : Auckland, 23rd and 24th November.
Helensville A. and P. Association : Helensville, 29th January, 1929.
Feilding A. and P. Association : Feilding, 5th and 6th February.
Dannevirke A. and P. Association : Dannevirke, 12th and 13th February.
Masterton A. and P. Association : Solway, 19th and 20th February.
Te Awamutu A. P. and H. Association : Te Awamutu, 20th March.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 26th July to 6th September, 1928, include the following of agricultural interest :—

No. 58060 : Honey uncapping-knife ; J. H. Roberts, Christchurch. No. 60619 : Fertilizer ; B. Bodero, Paris, France. No. 58585 : Seed-sower ; E. C. Houchen, Hamilton. No. 59331 : Wool bale ; R. D. Coghill, Dunedin. No. 59348 : Milk sterilizer ; F. de Boer ; Gorredijk, Holland. No. 60317 : Coating cheese with wax ; E. D. Berry, Palmerston North. No. 60634 : Device for separating wool-fat from wool-scouring wash ; J. and C. E. Thomson, Dunedin. No. 60721 : Trap ; J. P. Flight, Rangemore, N.S.W. No. 60727 : Device for flexibly securing animal traps ; Henry Lane (Aust.), Ltd., Sydney. No. 59177 : Hemp fibre, &c., treatment ; R. D. Coghill, Dunedin. No. 60693 : Horse collar ; D. MacQueen, Denmark, Western Australia. No. 60834 : Milking-machine ; E. G. N. and E. S. Salenius, Stockholm, Sweden. No. 60840 : Fencing dropper ; A. Arthur ; Northwood, Sydney, N.S.W. No. 60865 : Animal-trap ; H. C. Lane, Wednesfield, England.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington, price 1s. All fees must be paid in advance in cash or paid to the Public Account at a branch of the Bank of New Zealand and the bank receipt sent to the Patent Office ; or fees may be remitted by Post Office order or postal note.

Farm Dairy Instruction.—Referring to this subject in his annual report for 1928, the Director of the Dairy Division states : "Although this system of instruction to the suppliers to dairy companies has now been in operation for a number of years, it has not during the past year shown the advance that its importance warrants. There are now thirty-one Farm Dairy Instructors employed by dairy companies, as against thirty-three for the preceding year. One new appointment was made in the South Island, and three officers were dispensed with in the North. The combination of cream-grading and farm dairy instruction on a national basis would be of inestimable value in the improvement of milk and cream supplies, and it is urged that dairy companies give this matter their serious consideration."